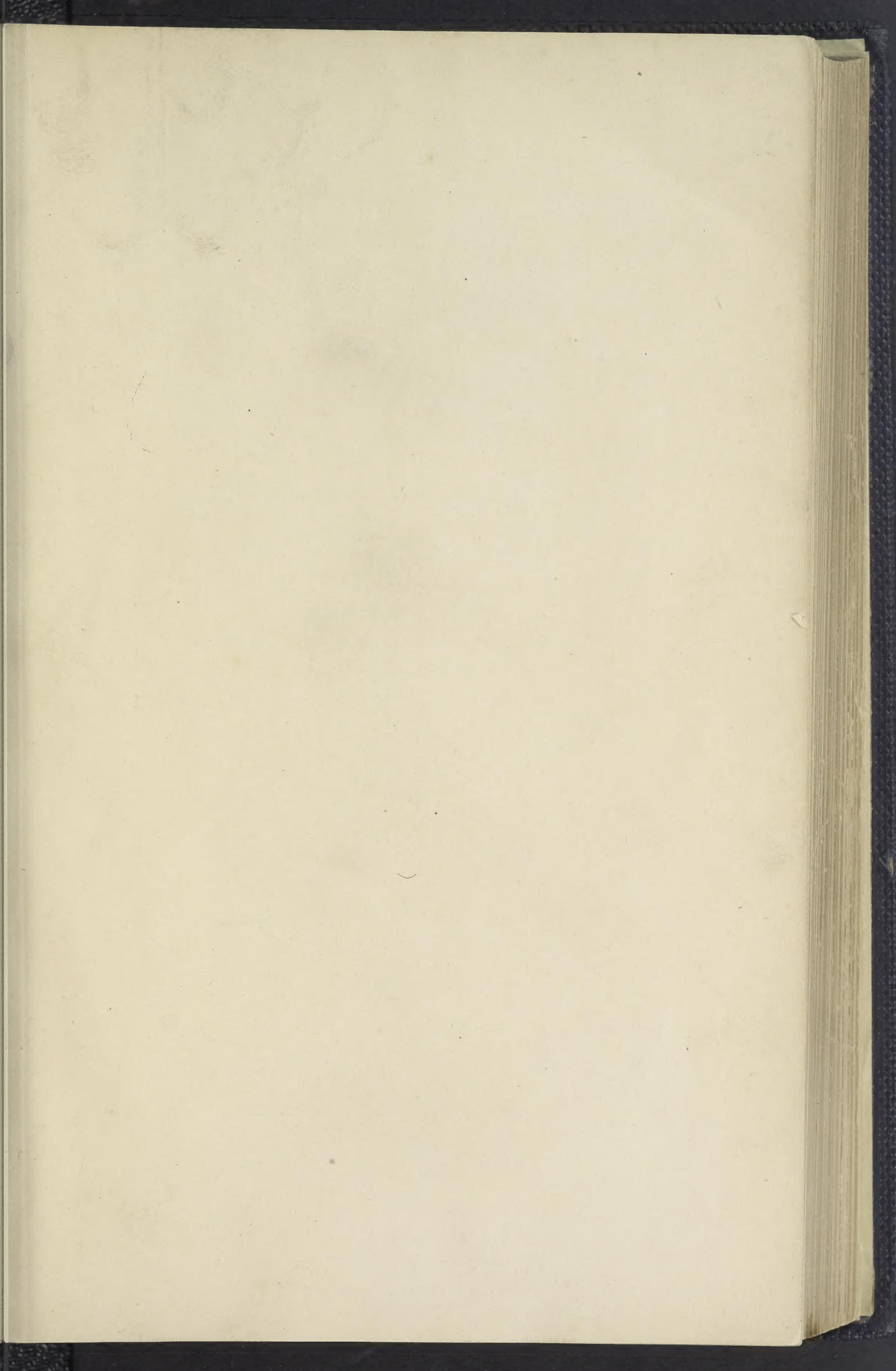


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THE
AMERICAN
PRACTICAL DYER'S COMPANION;

COMPRISING

A DESCRIPTION OF THE PRINCIPAL DYE-STUFFS AND CHEMICALS
USED IN DYEING, THEIR NATURES AND USES;
MORDANTS, AND HOW MADE;

WITH

THE BEST AMERICAN, ENGLISH, FRENCH, AND GERMAN PROCESSES
FOR BLEACHING AND DYEING SILK, WOOL, COTTON, LINEN,
FLANNEL, FELT, DRESS GOODS, MIXED AND HOSIERY
YARNS, FEATHERS, GRASS, FELT, FUR, WOOL,
AND STRAW HATS, JUTE YARN, VEGETABLE
IVORY, MATS, SKINS, FURS,
LEATHER, ETC. ETC.

BY WOOD, ANILINE AND OTHER PROCESSES,

TOGETHER WITH

REMARKS ON FINISHING AGENTS AND INSTRUCTIONS IN THE FINISH-
ING OF FABRICS, SUBSTITUTES FOR INDIGO, WATER-PROOFING
OF MATERIALS, TESTS AND PURIFICATION OF WATER,
MANUFACTURE OF ANILINE AND OTHER NEW
DYE WARES, HARMONIZING COLORS,
ETC. ETC. ;

EMBRACING IN ALL

OVER EIGHT HUNDRED RECEIPTS FOR COLORS AND SHADES, ACCOMPANIED
BY ONE HUNDRED AND SEVENTY DYED SAMPLES OF
RAW MATERIALS AND FABRICS.

BY

F. J. BIRD,

PRACTICAL DYER,

AUTHOR OF "THE DYER'S HAND-BOOK."

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PREFACE.

IN preparing this volume for the press the author has taken considerable pains to make it a popular exponent of the art of coloring.

As dyeing of textile fabrics is of vastly more importance than any other branch of the subject, most attention has been given to it.

The various methods employed by the English, French, and German dyers, including the old methods, or standard colors, obtained from woods, roots, barks, etc., and the new methods, or aniline colors, will here be found treated upon, and as far as practicable or desirable, set side by side, or closely following each other, so that the merits of both can be seen at a glance.

He has avoided technicalities and high-sounding phrases for the names and terms of the dye-house generally in use, and in most cases has made the metrical weights and measures conform to the English, in order to prevent as far as possible any error in using the formulas.

As brown, blue, and black are always the prevailing colors, he has given them the greater prominence and diversity, his object in so doing being not to perplex by multiplicity, but rather to present the various schools of practice, as experience has convinced him that one man will succeed much better with a certain formula than another, though they both use the same dyestuffs, and apparently follow the same plan.

Though red is not dyed so extensively as the prevailing colors mentioned, it has a greater variety of shades; considerable attention has therefore been given to their multiform hues and pro-

cesses. Other colors receive due attention in proportion to their relative values.

He has retained all the standard receipts that were in his former work, as they have given the same satisfaction to his readers as they did to him when in the trade. He has made but few alterations, as but few were required. He has, however, added many others to them, thus giving a much larger choice.

A careful selection of the new developments has been made to give a fair representation of what is not only new, but what is considered the most valuable. Indeed, every effort has been made not to omit anything considered essential to make the present work an acceptable guide in silk, wool, and cotton dyeing.

It will doubtless be admitted that other branches have received as full a share of notice as a book written chiefly in the interest of textiles could be expected to give, and the patterns have been chosen rather in regard to general usefulness than for novelty, greater prominence being given to colors or shades most in demand.

There never was, and never will be, a book gotten up to contain a match for every shade that may be brought to it, but the patterns will serve as a general guide, and on account of their diversity will enable a dyer of average ability to catch the idea of how to vary the formula given to suit his purpose. They have also been chosen to represent as many different classes of work as possible, so as to make it useful in all branches of the trade, with perhaps but two exceptions, leather and fur, which are of no great interest except to those engaged in them.

From the favorable reception of his former work he argues that this one will be none the less welcome, covering as it does a much larger field, and treating so extensively on aniline colors which were then comparatively in their infancy.

He now remembers one solitary man (since designated by the trade, the Grumbler Generally), who wrote to him, saying that he had read the book, and found nothing in it that was of any use to

him. Now let it be distinctly understood that this book is not written for those who know everything, but for those who know something, and wish to know more.

He had of necessity to use his discretion in selecting from the materials constantly pouring in from all parts, as—

Man's works with empty chaff are stored,
While some do golden grains afford ;
Reject the chaff, and spend thy pains
In gathering up the golden grains.

He has considered that what was most practicable was naturally the most valuable, and he found his twenty years' practice, and five years' hard study and experimenting most useful in deciding *pro* and *con*.

Everything thought to be of real service has been admitted, including some of less pronounced merit, for the sake of variety, and it is believed that the selections will give general satisfaction.

The silk industry having been developed into a considerable, if not national importance to this country, he has given it more prominence than can be found in any other book, as far as he knows, while felt, straw, feathers, jute, flax, linen, cocoa fibre, flowers, etc., find appropriate attention.

The mordants, dyestuffs, and finishing agents are treated upon as their importance demands.

While it is not claimed that this book will be a cyclopedia, yet this is claimed, that it will be a book of handy reference of strictly practical formulas, intelligible to dyers of ordinary intelligence.

The author wishes to acknowledge his indebtedness to Crookes' "Handbook of Dyeing and Calico Printing," for part of the standard methods of bleaching, and to a little English book (now out of print), "The Practical Dyer's Assistant," by Jno. Thompson, 1849, for some of the standard formulas for dyeing as followed by himself; and for some foreign matter to the *Chemical*

Review (London), and to the *Industrial Record*, and the *Dry Goods Bulletin*, New York.

Having received much encouragement from those who were benefited by his former work, *The Dyer's Handbook* (now out of print), and entreaties to publish another, the author hopes that this revised and greatly enlarged work will prove of yet more service, by which a recompense will be received for the long hours of diligent, honest work bestowed upon it.

He will add in conclusion that all the receipts given for aniline colors on mixed goods are of his discovery, he having some three years ago devoted considerable time to finding out, by practical experiment, the colors that would blend or work harmoniously together for producing all the off shades of colors, in order that the woods, barks, roots, etc. might be dispensed with if desired. The success achieved was considerable, some particulars of which published in the American Trade Journals were quickly announced in the European publications. As he has held until now these receipts as trade secrets, compounded to shade and sold to order, it may seem suicidal to publish them while he is yet in the business; but as many others since the publication referred to have turned their attention to the same thing with more or less success, and followed the track he marked out, he hereby shows his appreciation of a healthy competition by giving a general insight into his results, which it is hoped may still stimulate further research. He has no regrets for any pecuniary loss he may incur in such a cause, as he prefers to leave the world somewhat richer than he found it.

If we cry when we come into the world, it is well so to act our part that there shall not be wanting those who will shed a tear when we leave it.

F. J. BIRD.

BROOKLYN, N. Y., September, 1882.

TO MY READERS.

If thou wouldst learn the lesson well
That any teacher hath to tell,
Then thou must listen, ponder, weigh,
And give attention every day.

Don't think you know because you're old,
Don't think you know because you're told,
But reduce by practice carefully
The thing of which you'd master be.

The small details don't overlook,
Or 'twill be no use to read the book,
As you may condemn in letters bold
What may be worth their weight in gold.

I've tried to bring the useful down
To the simplest forms that can be shown,
And trust the least that you can say
Will be, " 'Tis worth what I did pay."

If less instructed there should be
Who yearn to learn new plans from thee,
Don't grudge to fully him make known
What others may to thee have shown.

The wise man liveth but to learn,
Then scatters knowledge in his turn,
Thus blessing, as he goes along,
The anxious and inquiring throng.

F. J. B.

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AMERICAN

PRACTICAL DYER'S COMPANION.

SECTION I.

SILK.

HISTORY OF THE SILK CULTURE AND MANUFACTURE IN CHINA.

SILK, the product of the *bombyx mori*, the silk-worm of the mulberry tree, owes, as is generally believed, its origin to China; at least the silk-worm, the mulberry tree, and the manufacture of silk textiles were long known in China before any mention of them appears in the histories of any of the ancient civilized nations. In Europe silk made its appearance in the sixth century, but long before, the trade in silk manufactures existed to a considerable extent between China and Persia. After the Persians had been conquered by the Macedonians under Alexander the Great, 325 B. C., silk goods were introduced in all the Grecian markets. Some writers believe that silk was known and used as a dress material even before this time among the Jews in Palestine, and they base their belief on the passage in Hezekiah (c. xvi. 10), in which the word "meshi" appears, which they translate "silk," yet even if it is admitted that the prophet here speaks of silk, it does not prove that the Jews manufactured it. He might have become acquainted with this textile during Babylonian captivity, but it is also doubtful if silk was known to the Babylonians.

In Rome silk goods were used towards the end of the republic. Afterwards, under Tiberius, men were prohibited to wear silk

garments, which, it was stated, were only fit to be worn by women, yet we know that A. D. 220, Heliogabalus made his appearance in public in silk garments. At that time the price of silk was so enormous that only the richest in Italy and Greece could afford to wear it. The Emperor, Aurelian, for instance, refused a silk dress to his wife on account of the great expense; this high price was not the consequence of its preciousness in China, but due to the difficulties encountered by Indian and Persian merchants in procuring the article in sufficient quantities. The communications which China merchants on the one side, and Indian and Persian dealers on the other were enabled to establish were so irregular and incomplete, and the distance from Byzantium to Serica (China) so enormous that it ceases to be a matter of surprise that these exorbitant prices were so long maintained. The route between Byzanz and the Himalaya Mountains exceeds 2400 miles, and a caravan from Ptolemaeus to Serica required not less than seven months.

For several centuries after the introduction of silk into Italy and Greece, it was held to be a composition of the leaves of certain trees, while others believed it to be either a very fine wool or cotton. Virgil, in his *Georgics*, according to his description of the Chinese, evidently believed that silk was made from leaves. But at the beginning of the sixth century, better information prevailed, and all the previous erroneous conjectures had disappeared. Two Nestorian monks had conceived it to be their duty during their sojourn in China to make themselves acquainted with the natural history of the silk-worm, and the mode of manufacturing silk as practised by the Chinese. As soon as they had gained all necessary information, they hastened back to Constantinople and reported to the Emperor Justinian the result of their researches. Fully impressed with the commercial importance of these reports, the Emperor induced the monks to return to China, and bring from there at all hazards a collection of silk-worm eggs. The monks had no difficulty in obtaining the eggs, but the transport had to be made in hollow bamboo canes; this importation proved so successful, and the silk-worms fed on mulberry trees multiplied so rapidly in the land of their adoption, that they were soon to be found in all southern European countries.

The Chinese work, *Hoai-nan-wary*, tells us that *Si-ling-shi*, the celebrated lady companion of the Emperor *Hoang-ti* (who reigned 2602 B. C.), was the first to raise silk, but already at the time of *Fo-hi*, the first ruler of China, silk threads were known.

The Chinese used silk threads as strings for their musical instruments, *Kin anschi*, long before they wove them into textiles, but, since the reign of *Hoang-ti*, it became the especial duty of the Empress and her ladies in waiting to superintend the silk culture, and manufacture of silk stuff manufactured by the court.

The Chinese celebrate every year a feast called the *Concon* feast, in honor of the lady discoverers of the silk-worm. On a fine day, I quote here from Mr. Murrow's *Hong Kong Chronicle and Directory of the Ninth Month*; the Empress appears before one of the numerous altars dedicated to the discoverer of the silk-worm, attended by princesses and a large retinue of lady nobles; after the sacrifice the Empress gathers in golden, and the princesses in silver chalices leaves of the mulberry tree, and feeds these to the imperial silk-worms; they then wind up a few cocoons, and the ceremony is ended. This time-honored festivity is a counterpart of the agricultural feast executed by the Emperor in the spring of the year.

This, however, is not the only homage to *Si-ling-shi*, as goddess of the silk-worms. She receives high adoration in several important temples in the province of *Tsche-Kiang*, at which mandarins act as priestly functionaries. It is natural that an adulation thus inaugurated and encouraged by the highest and noblest in the land finds many imitators in the provinces, and especially among the districts producing silk goods.

According to the Chinese work, *Tsau-hiry-shu*, there are twelve kinds of silk-worms:—

1. The silk-worm who holds three sleeping periods, and whose papilio pairs once a year. (These were first introduced into Europe, and are known in Italy, under the name of *terzeni*.)

2. The one who holds four sleeping periods, and whose papilio pairs twice.

3. The silk-worm with the white head.

4. The so-called *Hi schi-tsan*.

5. *Tsu-tsan*, the black silk-worm of the province *Tsu*.

6. He-tsan, the black silk-worm.
7. Hoo-cultsan, the ash-colored child.
8. Tsin-mu-tsan, bred by an autumn papilio.
9. Tsin-tschong-tsan, which appears in the middle of autumn.
10. Leu-tsin-eul-tsan, the old child of autumn.
11. Tsin-wei-cau-hiai-tsan.
12. Kin-eul-tsan, the gold stuff child.

In a description of the procedure in the manufacture of Chinese silks, it seems to me the most important point is the culture of silk-worms. Those to whom this labor is intrusted, select a number of male and female cocoons; this is apparently not difficult, as those cocoons containing males are pointed and smaller than those containing females, whose cocoons are thick, round, and soft. After fifteen to twenty days, the caterpillars slip out and emit a fluid, through which a portion of the cocoons get loosened. All papilios whose wings stand apart at birth are considered useful, while those having crumpled wings, no feeler, etc., red abdomen, or thin back part of the body, or with down, are adjudged as worthless and killed. Of those which have been selected, the males are only put to those females which have left the cocoons on the same day, and every deviation from this practice would be contrary to the conception of a Chinese silk-worm raiser. After one day the males separate, and the females are placed on a sheet of rough paper, where they lay their eggs. In the northern part of China pieces of cloth are substituted for paper on account of the severity of the climate. The number of eggs which a female lays amounts to about 500, and the time occupied is seventy-four hours. The females die almost immediately after they have laid their eggs, and the males also do not live long after. The eggs are about the size of a poppy seed. After the lapse of eighteen days, the eggs are carefully washed, for which purpose the sheets of paper or pieces of cloth to which they adhere are carefully drawn through earthenware or wooden vessels filled with water. During the autumn months the eggs are kept cool in a room, the sheets of paper hung up back to back on horizontally placed bamboo canes. In the tenth month of the Chinese year, which corresponds to our December, the sheets are brought into a clean room, which must also be free from all pernicious influences. On

the third day of the twelfth month the eggs are again washed and brought into the air to dry, in the spring. At last, when the eggs are ripe, the sheets placed on bamboo hurdles, are put into a clean warmed room. Bamboo is the best wood for this purpose, as it is void of all aromatic effluvia. At the time of their birth the worms are black and as thin as a hair; these diminutive creatures receive leaves of the mulberry tree finely cut up with very sharp knives, so that the juice of the leaf may be retained by them.

During this early existence the worms are fed no less than forty-eight times in twenty-four hours, afterwards thirty times, and when full grown only three or four times a day. Occasionally, viz., once or twice in the first month, they are fed with mulberry leaves, well mixed with bean or rice flour. It is supposed that this mixture is productive of stronger and glossier silk. Like most other spinning insects, these worms have also their times of rest, for which the Chinese have different terms, the first sleep four or five days after birth lasting like all the three first sleepers. Only one day they call hair sleep. The second sleep takes place on the eighth or ninth day, the third on the fourteenth, the fourth and last on the twenty-second day, so called on account of its longer duration ($1\frac{1}{2}$ days), the big sleep on the approach of the sleep between which the feeding periods occur. the worms lose their appetites, they lift the fore part of their body and sleep in this position. During every sleep the worm loses its skin and does not awaken until a new one has taken its place. He relieves himself from the old burden by keeping the head out of the skin, the skin finally suddenly bursting. Sometimes the worm, not able to free the hind part of his body, dies. As soon as the skin is burst the worm begins to grow rapidly.

Between the first, second and third periods of the rest these little creatures are very voracious. During the first four or five days after the big sleep the appetite of the worm is the largest. When they are thirty-two days old they are full grown, nearly as thick as a little finger, and about two inches long. During the time of their growth they are frequently separated in special vessels to give them more room. The full grown worm is of an amber color. Now is the time when they must cease to feed and

begin to spin silk (with their mouths) on to the hurdles or frames on which they were hitherto placed. While spinning, the worms move their heads from side to side until the whole body is covered in a cocoon. This takes from three to five days. As soon as this is completed the silk-worm falls into a lethargic state, loses its skin and transforms itself into a chrysalis. The attendants now bring the bamboo hurdles near to a clear and quiet wood or charcoal fire for the purpose of destroying the larvæ, which otherwise would turn in about two weeks into butterflies.

After the larvæ are destroyed the cocoons are gathered into baskets. Women and girls wind up the cocoons by laying the same in boiling water. The outer silk, flock silk, is first removed. After which other working women, especially trained, wind up the inner silk, called "silk pulp," or gallata. With expert work-people the gathering of the silk lasts from eighteen to nineteen days, with ordinary ones twenty-four to twenty-five. Long, white and glossy cocoons yield a thin, good thread of silk; others, which are broad and of loose texture, give a coarse thread which is manipulated into lining stuffs. The larvæ are by the by not thrown away, but an excellent dish is prepared by the work-people and eaten.

In the silk districts of Canton there are seven seasons, or harvests. The first begins in the month of April. During the first, second and third seasons the cocoons are mostly green, only a few are white. Cocoons are numerous. It is singular that in the first season the eggs are all allowed to develop without any attendance, no doubt on account of the mildness of spring weather. To attain an equal development of the eggs of all the six seasons, and to insure their being hatched at one time, the attendants pour warm water of suitable temperature upon the eggs of the latter seasons—a kind of artificial hatching, and thus the worms appear all at the same time.

There is also a seventh season, called the cold season, for in the month of November, after which the mulberry trees are cut close to the ground, the mulberry trees, or better, the leaves of the same form, are a very important staple of commerce in the silk districts of China. The farmers who cultivate this tree bring the leaves by boats to the large silk cities—Wong-ling, Tuck-low,

Kevan-tung, etc.—and it is highly interesting to see these busy marts. The foregoing description will show the great care bestowed upon the culture of the silk-worm by the Chinese. They bestow special attention upon the proper temperature of the rooms in which the worms are kept, not by the thermometer, but by entering the room from time to time in a nude state. Lightning is considered injurious to them, hence they are covered with sheets of thick brown paper as soon as heavy weather approaches. Thunder also and any loud noise is detrimental to these delicate creatures, so that the attendants are only permitted to speak in very subdued voices when near them. It is important also to recollect that the leaves with which the worms are fed must be perfectly dry, not old and withered, but quite fresh; else the worms will fill with waste instead of silk and become constipated. They are removed to the wicker-work frames only when the weather is bright and clear. If these rules are not followed the cocoons will be rough and incomplete. The houses devoted to this culture are large and extremely clean, free from all pernicious smell, and the greatest punctuality is enforced upon all the attendants. It is natural that so delicate a creature is liable to sickness. There are two maladies which are most prevalent, the foong-tsun, flatulency, and the tsak-foong, consumption. The first is especially fatal, and should the worms even live through, their silk will be far inferior. The second is caused by exposure to draft. The symptoms are stiffness and the appearance of a bright red color. It is therefore that the Chinese employ a special attendant to see to the careful opening and shutting of doors of a breeding-house. Flies are especially kept away from them, as they not only suck their blood, but also lay their eggs upon them.

Some of their precautionary measures are, however, very comical and superstitious, for instance, women when enceinte are not allowed to enter the room where the silk-worms are kept. It is also forbidden to persons in mourning for the period of forty-nine days. No attendant is allowed to eat pepper or tsam-ton beans near to the breeding places; roasting or cooking with oil is prohibited. In fact, nothing which emits an aromatic smell is allowed; and no visitor passes through the door of a room in which the precious silk-worms are kept without having previously

sprinkled himself with water, for which purpose a basin with water is kept near every door. In the silk districts of the north they throw a few grains of sand on the head of all strangers entering these industrial sanctums. In Tai-laong are considerable establishments for silk culture. The silk towns of the province Kwang-tung are very clean and pretty, and totally different from other Chinese towns. Every establishment stands isolated, occupying much room and entirely surrounded by mulberry trees. Thus they keep away all injurious noises and exhalations. The silk houses are well built of brick and the footpaths leading to them are well paved. In the province of Kwang-tung are also the following towns of most importance: Know-hong, Kum-Schok, Loong-Schun, Loong-Kong, Sha-tow, Nam-poon, Lak-low, Wang-sui, Yoong-ak, Tai-laong, See-ne-lam, Hung-tom, Shooll-tung, Kat-ngawn-kwee-schow, Yong-kee, Kro-toong, Kulyow, Taw-Schooll, Wong-tam, Ko-schune, Wong-ngwane-hoong-kan, Kwang-wa, and Pak-kow.

The total silk produced in this province is about 100,000 kilos, 220,000 lbs. per annum. In every one of these cities is a market in which the silk is sold in its rough state. These markets are covered in and surrounded by high walls. The buyers are chiefly European merchants and the weavers of Canton. The looms used by the latter in flat weaving are similar to ours; for the weaving in flowers and ornamental goods, they use a very primitive loom, and, considering the extreme conservative character of the Chinese many years will elapse before the Jacquard is adopted by them.

Canton is celebrated not only for its fine gauzes, but its silks and satins also. The palm in the production of gauzes is, however, carried off by the city of Tang-yang-Hien. This elegant textile is much used for summer garments by the mandarins and the Chinese upper classes. A very large number of the Canton weavers earn their livelihood by weaving those broad silk ribbons used by the Chinese ladies to envelop their little feet. They are not used, however, as some travellers have erroneously reported, as bandages to effect the shortening of the feet, for which purpose a more common material is used, but as an ornament for their crippled feet and even the whole leg.

The Chinese skill in embroidery work is, as is well known, of a

very high order. Canton especially is celebrated for its magnificent productions in this industry; its altar cloths, banners, and state garments are of surprising beauty. The crape shawls for which the Chinese are so justly celebrated are principally manufactured in the city of Pa-Kow in the province of Kwang-tung.

They also breed in China an inferior class of silk-worms called the oak-spinner. These worms are pretty large. Their home is in Japan, but they are also found in Mongolia and Mandsuria. These worms produce the so-called mountain silk, and the textiles manufactured out of it are very rough.

And it is astonishing how large a selection is kept there in addition to the immense stock of goods made on the premises. A large corps of travellers represent this house on the road, and it is safe to say that he is the leading and representative manufacturer in his line.

SILK INDUSTRY OF PATERSON, N. J.

From the smallest beginning, in 1839, Paterson now lays claim to the title of the Lyons of America. The silk manufacture of Paterson has developed into enormous proportions, and yet we believe it is but just on the threshold of its ultimate career.

The beginning was hard, the progress slow, discouragement and disappointments many, but the victory has at last been made complete. There are now made in this country, and mainly in Paterson, a great variety of silk goods of better quality than the same goods made abroad. The largest silk factories in the United States are in Paterson.

Skilled operatives have been drawn to this silk centre from Macclesfield, Nottingham, Coventry, Lyons, St. Etienne, and from Italy, Switzerland, Germany, and Holland, and all have found remunerative and satisfactory work at better wages than they received in the old country. This foreign population rapidly adapt themselves to the customs of the country and settle into excellent citizens, acquiring means and homes. The total production of silk in Paterson for eleven years past has been as follows:

1870	.	.	.	.	.	.	.	.	\$4,263,260
1871	.	.	.	.	.	.	.	.	8,017,172
1872	.	.	.	.	.	.	.	.	9,556,700
1873	.	.	.	.	.	.	.	.	6,977,264
1874	.	.	.	.	.	.	.	.	5,217,616
1875	.	.	.	.	.	.	.	.	7,162,948
1876	.	.	.	.	.	.	.	.	7,467,756
1877	.	.	.	.	.	.	.	.	7,454,780
1878	.	.	.	.	.	.	.	.	9,076,968
1879	.	.	.	.	.	.	.	.	13,306,672
1880 (6 mos.)	.	.	.	.	.	.	.	.	9,156,480

The following figures give a view of the silk manufacture of Paterson at the present time:—

Silk Manufacture.

Number of firms and corporations	.	.	.	.	80
Total number of operatives	.	.	.	.	12,158
Disbursed fortnightly in wages	.	.	.	.	\$157,305
Disbursed annually in wages	.	.	.	.	\$3,869,930
Capital in mills and machinery (about)	.	.	.	.	\$9,000,000
Number of power looms	.	.	.	.	2,518
Number of hand looms	.	.	.	.	1,128
Number of throwing spindles	.	.	.	.	143,618
Number of braiding spindles	.	.	.	.	55,838
Square feet of flooring space used	.	.	.	.	1,357,452
Pounds of raw silk used per year	.	.	.	.	1,289,200
Value of finished product (for 1879)	.	.	.	.	\$13,306,672

Silk Dyeing.

Number of firms in addition to private dye-houses	.	.	.	.	10
Number of men employed	.	.	.	.	742
Amount disbursed in wages per year	.	.	.	.	\$397,350
Capital invested (about)	.	.	.	.	\$280,550
Value of product per year	.	.	.	.	\$4,125,750

CAN WE RAISE OUR OWN SILK?

Many of our States, especially Ohio, the eastern part of Kentucky, Tennessee, and northern Georgia, are very well adapted by soil and climate to the production of silk. Several species of mulberry trees, as good for feeding the worms in their early growth as the white mulberry, are found wild from Pennsylvania southward, and are readily raised in other sections. The foreign

mulberry has been much introduced, and is acknowledged to be superior in quality to that of Europe, and equal to that of China. Our southern climate is particularly favorable to the rearing of the worms, which, as they can be more generally fed in the open air than in Europe, are much healthier. While half of them are unproductive from disease in the Old World, the proportion here is only one-fourth. The business was very seriously hurt by the extraordinary speculative mania which broke out in 1830 and raged for several years. In 1844 the total product of silk cultivated in the Republic was 396,790 pounds, worth \$1,400,000, and in 1850 it was only 14,763 pounds. Of late, silk cultivation has grown materially within our borders; and there is no reason why it should not become a very important industry in the south. Some persons have prophesied that, within a quarter of a century, if proper attention be paid to it, it will reach \$25,000,000 to \$35,000,000 annually. Thus far it has not received, unless in California, any proper degree of care, and when it does receive such there would seem to be no rational doubt of its prosperity. Many of the experiments of the north have been unsatisfactory, and have discouraged efforts in the south, where climate and all conditions are auspicious. Our manufactured silks are excellent in many respects, and we expend so very much for silk—all our women dress in it—we ought to raise a considerable part of it on our own soil.

SILK WASTE IN JAPAN.

The Japanese make a kind of silk wadding, called mawata, from the waste cocoons, which they use for the purpose of lining their clothing. They dip these otherwise useless cocoons into a lye of wood ashes, or ashes of rice straw, and then open those which require it to remove the chrysalis; the silk taken from each cocoon is then expanded by the simultaneous action of the thumb and first finger of each hand and this thin layer put upon the ends of thick nails placed into an inclined board. When from twenty to sixty such films have been placed upon the nails they are allowed to dry. Sometimes the silk will be found in such good condition that it can with care be spun by hand, in which case it will furnish a coarse thread which is used for fabrics of a lower quality.

UTILIZATION OF SILK WASTE.

Accident showed Samuel Lister a new world that was waiting to be conquered. Going one day into a London warehouse, he came upon a pile of rubbish which strongly attracted his attention. He had never seen anything like it before. He inquired what it was, and was told that it was silk waste. "What do you do with it?" he asked. "Sell it for rubbish, that is all," was the answer, "it is impossible to do anything else with it." Mr. Lister felt it, poked his nose into it, and pulled it about in a manner that astonished the London warehousemen. It was neither agreeable to the feel, the smell, nor the touch; but simply a mass of knotty, dirty, impure stuff, full of bits of stick and dead mulberry leaves. In the end Mr. Lister made the offer of a halfpenny a pound for the "rubbish," and the sale was there and then concluded, the vendor being especially pleased to get rid of it on such advantageous terms.

When Mr. Lister got this "rubbish" down to Manningham, he spent a good deal of time in analyzing and dissecting it, and he came to the conclusion that there was something to be done with it. He found silk waste was treated all the world over as he had seen it treated in the London warehouse—as "rubbish." Mr. Lister now set his heart upon inventing machinery that should be able to manipulate this waste and imperfect product of the silkworm into fabrics that should vie in appearance with materials manufactured from the perfect cocoon. He engaged a number of skilled workmen from foreign countries—men well acquainted with the manufacture of silk in all its branches—and, although at first they viewed their master's experiments on silk waste with suspicion and distrust, they eventually came to think with him that there was "something in it." Mr. Lister spent £360,000 in perfecting machinery for the manufacture of silk waste before he ever made a single shilling by it.

In the year 1865 Mr. Lister had accomplished his task; he had subjected silk waste to so many intricate and delicate operations that he was able to manufacture from it velvet fabrics of great beauty. Many machines had to be invented—machines on a very gigantic scale—before the preparatory processes could be successfully

mastered; and when this had been done there was the velvet loom to bring into operation. This loom, which is the invention of Mr. Reixach, a Spaniard, gradually grew into a tangible fact, however, and it is considered to be a *magnum opus* as an invention. Mr. Lister bought this patent, and engaged the inventor's son to superintend its carrying out.

Mr. Lister made extensive arrangements for producing the raw material in its perfect form on an estate of his own; he accordingly purchased an estate of one thousand acres in Assam. It was found, however, that the difficulty of obtaining labor in that part of the East was so great that the idea of producing raw silk there had to be abandoned, and the estate was transformed into a tea plantation, and has been used as such ever since. More recently Mr. Lister has become possessed of extensive estates in the Punjab and Dehra Doon, where the Assamese worm has been introduced with considerable success, and where, also, the Italian and Japanese worms are being largely cultivated. The Assamese worm, it may be mentioned, does not feed upon the mulberry tree, but upon the castor-oil plant, which produces five crops a year, the leaves of the plant remaining fresh all the year round.

Everything that enters within the gates of Manningham Mills is utilized in some shape or other, a surprising variety of articles being produced in all from silk waste. The following may be enumerated by way of example: Silk velvets, velvets with a silk pile and a cotton back, silk carpets, imitation sealskin, plush, velvet ribbons, corded ribbons, sewing silks, Japanese silks, poplins, silk cleansing-cloths for machinery, bath-towels, floor-cloths, dish-cloths, and so forth. And all these from the once despised silk waste! The consequence has been that silks have been greatly cheapened, and that a material which was regarded as worthless has come to have a value in the market, the price obtained for silk waste being now very greatly in excess of the original price paid by Mr. Lister.

CLEANING, BLEACHING, AND DYEING SILK.

No. 1.—*To Cleanse and Bleach Silk White.*

For twenty ounces of silk, make up a hot bath with five ounces of curd soap, in which the silk is turned for one hour. Then make up a new bath with four ounces of soap and work again for one hour, this ungums it. Now rinse in cold water. Sulphur three times and steam after each sulphuring. Rinse cold. Then give a few turns in a good fat soap, hot, wring up and tint in a fresh soap with Alkali Blue, wash twice, then give a few turns in a bath of cold water and acetic acid.

Ammoniacal Cochineal and Alkali Blue in their proper proportions give all the tints desired.

No. 2.—*Washing Silk.*

While in Europe the first process in a silk-throwing mill is to wash the silk with soap in order to remove the gum contained in or upon it, the Chinese are supposed to do this without soap, though the information which has been obtained on this point is not at all reliable as to the details of the actual manipulation. At the commencement of this century a Swede (Grubbins) professed to have seen and practised himself, in China, the washing of silk, which, according to his information, consisted in submitting the silk to a kind of fermentation which destroyed the gum in the course of a few months. This mixture was said to consist, according to Persoy, of water, salt, wheaten flour, and a paste or leaven made from beans, and prepared beforehand in a peculiar manner. Those who have tried to follow these directions have not succeeded, from which we infer that some important items of manipulation have not been divulged. Later information has, however, led to the belief that the Chinese now decompose the gum on the silk with the assistance of carbonate of potash, which seems a more likely proceeding to attain this end.

No. 3.—*Sulphuring Silk.*

The silk to be sulphured is washed when removed from the boiler where it has been boiled, and suspended when still moist over sticks in small rooms filled with sulphurous gas. At Lyons the walls of rocks on the banks of the Saone have been utilized for the building of sulphuring chambers. Usually rooms are constructed with masonry and their walls lined with lead, the object being to screen these chambers from all external influences. Apertures admit ventilation when the sulphuring is done. The knots of skeins are placed at a slight distance from each other, and when everything is ready for the operation sulphur is made to burn in the rooms, either in a cast-iron pan as is done at Lyons, or in the hollow of a big stone as is practised in Switzerland, as described by Mr. Philip David in his technical treatise. According to this gentleman there are taken 500 gr. (17.5 ozs.) sulphur to every 10 kilos. (22 lbs.) of silk; the sulphur is crushed before it is placed in the hollow of the stone; fire is then applied to the sulphur either by means of a red-hot iron plunged into the mass of sulphur and left to stay there, or, better still, a piece of sulphur is fired and the burning drops from it are made to fall on the mass.

As soon as the sulphur is on fire the door leading to the chamber is hermetically closed with strips of wood. The sulphur combustion continues for a time, then slackens, and ceases as soon as the atmosphere has lost most of its oxygen. The hard residue on the stone is broken to pieces and burned over again by adding a little fresh sulphur. The sulphuring is continued for twenty, thirty, or forty hours, according to the degree of whiteness to be given to the silk. After this operation shall have been performed a vigorous ventilation renews the air and the knots of skeins are withdrawn in order to desulphur them by simply smoothing them in tanks filled with water. As a moderate degree of warmth facilitates the action of the sulphurous gas, some dyers during the cold season entertain a slight circulation of steam through tubes in the sulphuring chambers, thus keeping up a suitable degree of temperature, not however to be exceeded for fear of accidents.

As for the effect upon operatives a large amount of sulphurous gas inhaled by them of course affects the respiratory organs to a

certain degree, but as there is an access of plenty of air while they handle the silk in the chambers, the injurious action is neutralized and the workmen generally enjoy good health; some have been known to attend to this kind of work during ten and even twelve consecutive years without injuring their health in the least. Chlorine is a great deal more detrimental to health.

"The softening of silk" is a process which changes the natural color but little; but whenever the silk is to be dyed a delicate color, a suitable bleaching has to precede the operation. Hence softened silks are either "unbleached" or "bleached," and the latter are subdivided into "half-white" for medium colors, and "all-white" for the lightest of tints. The treatment of all these species is different; we will assume "bleached soft silk," and state how the treatment is usually carried on at Lyons and St. Etienne.

Scouring.—The silk is immersed in a first bath, lukewarm, and with 10 parts of soap in it to every 100 parts of silk; the temperature is then raised to 25° C. (77° F.), 30° C. (86° F.), or even 35° C. (95° F.), and the fibre allowed to remain in it for an hour or two, smoothing it three or four times, if possible, between two sticks, in order to moisten it well when wringing it. The real object of this process is not so much the scouring of the silk as the one of causing the sprigs of the fibre to expand, to open its pores, and thus to get it ready for the operations to follow. This first soap-bath is followed by a second similar one, in which the above manipulations are repeated; the silk is then washed and bleached.

Bleaching.—Dyers call a "bleaching-bath" or simply "bleaching" an *aqua regia*, prepared by mixing five parts of hydrochloric acid with one part of nitric acid. Previous to being used this preparation is exposed for at least four or five days to a moderate heat of about 25° C. (77° F.). It is then very much diluted and reduced to a strength of 2.5° to 3° Beaume, which corresponds to about 20 litres (5.28 gals.) of the mixture for every 300 litres (79 gals.) of water. This dilution is performed in large rectangular troughs cut into silicious blocks of stone or deal tanks. The liquid must have a temperature of 25° C. (77° F.) to 35° C. (95° F.). The knots of skeins are placed on sticks and they are

plunged into the bath and stirred continually, smoothing them out rapidly and moving them from one end of the tank to the other. Usually the operation requires one-quarter of an hour, but at times it is finished in ten minutes and even less, as the case may be. As soon as the bleaching is terminated the silk must be taken out, so that too long an exposure to the acid may not injure the same, for if thus damaged it would be but partially discolored and then turn yellow never to lose this color; hence great precaution is necessary. Besides, silk to be bleached should be of one uniform nature, so that the decoloring may take place with uniform rapidity. Some dyers have for this reason preferred a cold process, and other substances such as azoto-sulphuric acid or chlorate of potassa with mineral acids. As soon as the desired effect has been reached, the knots or skeins are taken out and immersed in succession in two tanks filled with water, so as to remove without delay the acidulated liquid adhering to them. They are then sulphured, as we have indicated above. When removed from the sulphuring chamber the silk is hard and brittle to the touch.

The Softening Process.—As soon as the silk issues from the sulphuring chamber it is plunged into boiling water for some time with an addition of cream of tartar. The operation is carried on in a wooden tank with about 3 kilos. (6.6 lbs.) of cream of tartar to every 800 litres (211 gals.) of water; the heating is done by steam through a tinned tube. It is worked and smoothed in this bath for about an hour and a half. It will soon change in outward appearance and soften while expanding. It becomes spongy to the touch, absorbs water with greater ease, and takes the dye more readily. Softening is of the greatest importance, and it is prolonged more or less according to the kind of silk to be treated. Warps for the weaving of silk tissues of good quality have to be handled very carefully. Lighter articles require less softening. Practical familiarity with the weaving department will be the only guide in this matter. The operation is wound up with a tepid bath intended to thoroughly wash the fibre, and above all to cool it down while keeping the sprigs isolated from each other so as to prevent agglutination. It is therefore smoothed in this bath repeatedly. Cream of tartar is not indispensable; it may be replaced by sulphuret of magnesia or acid sulphate of soda; preference is nevertheless given to

cream of tartar, for it is less dangerous than the other substances named, which are too much whetted by sulphuric acid, and for superior manufacturing the use of cream of tartar is therefore more advisable. It is a fact not to be overlooked that the softening process causes the silk to lose more of its viscosity than perfect cleaning.

No. 4.—*The Dyeing of Silk and Cotton White. For Mixing Dyeing Scoured Silk White.* (By Marius Mayret.)

Remarkable progress has been made in dying white both scoured and raw silk, the result to be reached being the same, that of getting rid of the dull yellowish color peculiar to silks, in order to replace it by tints more pleasant to the eye. The substances should not draw too fast, the same as raw silks, boiled, should be treated with very weak baths, so far as coloring matter is concerned, and they should be neutral. They should even be saturated with carbonate of lime by adding chalk or ground alabaster while in water, whenever it is intended to be dyed with indigo carmine or ammoniacal cochineal, the same as in raw. Annato and aniline violet colors may afterward be applied on soap baths and tepid. When boiled silk is removed from the dyeing bath the same care must be taken with which white or raw silk is handled, so as to be able to wash it well. It is then either enlivened or not, at the pleasure of the manufacturer.

Organzines dyed white, boiled, are one of the most delicate articles for the dyer to deal with. The greatest precaution will be necessary till they are finally dried; but in compensation this is the best shape in which silk retains both its strength and its elasticity.

No. 5.—*A Charge of White on Scoured Silk.*

When silk is boiled it loses in weight according to quality from 18 to 27 per cent. It may be charged or loaded ere it is boiled, either with sulphate of barytes or bichloride of tin, called charge X. This latter charge or weighting usually adds 25 per cent., nay, even as much as 40 per cent. As they are, however, both metallic, they spoil the touch of the silk despite the soap that

passes over them, and are therefore deprecated. A very pure syrup may be used and thus some of the loss recovered, but even this will be at the expense of the fine characteristics of the silk. There is consequently no rational charge for white, and the best the weaver can do is to cling to pure silk.

No. 6.—*Pliable Whites.*

White on soft silk is usually applied on the tram (or weft silk). Softening is quite a modern operation and has created a special kind of silk placed midway between scoured and raw. The dyer, whenever he wants to obtain a softened white, will, in the first place, have to endeavor to fix the boiling at a point where it leaves the silk albuminous portion of sandy matter, thus leaving it more weight than if the same were thoroughly boiled. The pliable white dyeing embraces the ensuing operations: the bleaching for the soft process, the softening of the discolored silks, the dyeing of the softened silks, the enlivening, the charge (weighting) of the softened silk, and finally, the wringing operation.

No. 7.—*The Bleaching of Softened Silk.*

The bleaching of silk intended for the softening process is done precisely as though raw silk were to be manipulated. Indeed, the treatment only varies from the moment the silk leaves the sulphuring room. When it is removed from the latter, it is not desulphured, but is immediately subjected to the softening manipulation, a most delicate process.

No. 8.—*The Softening Process.*

When the softening is done for white it takes the silk as it issues from the sulphuring chamber. The methods used by various manufacturers differ a good deal, much being left to the judgment and caprice of the operator. The fact is that silk when treated with acidulated water, nearly at the boiling point, for some time, loses its gelatine and a waste occurs, which with French silk may reach as much as 15 per cent. Both white and colored when softened are finally wrung.

No. 9.—*Dyeing of Soft Whites.*

The dyeing of a white for softening takes place the same as previously indicated. As, however, the salts of lime affect the touch, granitic or soft water should be given the preference. In France the water of St. Chamond and St. Etienne is excellent, for it is always slightly alkaline, containing as it does silicate of potassa, which dispenses with adding bicarbonate of lime whenever the silk is to be dyed with ammoniacal cochineal or indigo carmine.

Softened silk may either be enlivened or not, as the case may be, *i. e.*, according to the purpose for which the same may be intended. At any rate it has always a tendency to unstring and get downy, and in order to overcome this drawback there is added to the enlivening bath a little gelatine, say 5 to 6 per cent. of the weight of the silk, isinglass being the most suitable substance of a gelatinous kind. Whenever the gelatine dries on the fibre it operates as a sizing. If no enlivening process be applied, the passage through gelatine takes place alone.

No. 10.—*Charging Softened Silk.*

The same has been indicated with reference to scoured silk. The saccharine charge with syrup is the only advisable one, and it is carried out with the same precautions. As a general thing the sugar treatment has for its object to recover the weight lost by the softening process, and consequently to restore to it the weight it possessed when the dyeing commenced.

No. 11.—*Of Whites for Highly Loaded Silks.*

These Whites do not differ much from those for scoured silk except in a few details. They are always applied to boiled silks. For grenadines they have to be boiled with a good stretching apparatus in which the silk does not shrivel. Brades or flakes may at pleasure be boiled with soap or caustic soda. The great point is to wash them carefully, and subsequently beat them on a stone so as to purge them thoroughly. The sulphuring is done in the same manner as fine silk, and the dyeing of well-decolored silk is also done after the same method. Another important operation

is the finishing of grenadines, braids, and flakes. Sometimes a strong touch has to be given by enlivening with some acid, and a little strength may be imparted by means of gelatine, as has been shown in connection with soft silks. Then again, it may be necessary to avoid the hard touch, or it may even be requisite to give them a very soft touch, like, for example, when intended for sewing silk.

No. 12.—*Whites on Fancy Chapes, Flakes, and Braids.*

All fancies and chapes are treated the same as fine silk with soap, but one passage through it will suffice. The soap may be pretty greasy; flakes and braids are in preference scoured with caustic soda which burns the down a little while boiling. As for washing it is done the same as with heavily loaded silk, *i. e.*, the dyeing, the enlivening, if a hard touch be desired or claying to get a soft one before they are manufactured, when being dyed they undergo a special singeing process which destroys the down. All silk goods or fancies in the line heavily loaded are intended to be used for lace, upholstery, embroidery, or dress-making, and they are all treated alike, but fancies are usually more exclusively treated with caustic soda than the heavily loaded ones, and fancies and their derivatives are exclusively subjected to the singeing process.

No. 13.—*The Dyeing of Tussah Silk on White.*

Wild or tussah silk has not yet succeeded in becoming a formidable rival of real silk, for it is not easy to bleach and thoroughly dye. Yet as regards white silk good results have been obtained with tussah by following the method prescribed by M. Lussie du Mottay. Two operations are required, *i. e.*, the scouring and the bleaching. The scouring requires no special manipulation beyond the ordinary one, for it is done in a diluted caustic soda bath of a temperature of 60° to 80° C. (140° to 176° F.); the silk is therein, properly speaking, more cleansed than boiled, and the loss of weight varies very much, fluctuating as it does between 10 and 20 per cent. When these silks are well purged they lose somewhat of their brownish color, of their hard touch, and disagreeable smell, and they are then well bleached. They are thoroughly washed after they are

boiled in a cold bath of hypermanganate of potassa. In this bath they first assume a dark chestnut color while the bath is discolored. This no doubt arises from the oxidation of the coloring matter of the silk by virtue of an excess of oxygen of the hypermanganate. The bath is discolored in consequence of the destruction of the hypermanganic acid, while there is precipitated on the fibre a less oxygenated product of the manganese the bioxide and the latter dyes it a chestnut color. The silk is then immersed in a slightly acidulated sulphuric acid bath, or one of bisulphite of soda, which removes the entire precipitate bioxide of manganese. The influences thus brought into play in turn by the oxidating and reducing substances used, finally succeed in bleaching the wild silk. This will, however, not be possible if by chance the tussah silk-worm has found its nourishment on oak leaves, for the latter contain too much tannin, and the silk spun cannot be discolored. After the silk is bleached it receives a slight bluing, and may subsequently be dyed with other colors if desired to get the precise white wanted, coming up as it does closer to real silk than any other substitute that we know of.

No. 14.—*Dressed Cotton Dyed White.*

For about fifteen years past the high price of silk has caused manufacturers to have recourse to a substitute with which to mix, *i. e.*, a twist called dressed cotton, which nowadays plays a prominent part in the weaving of silk. There are selected for it the very finest and most uniformly spun threads, and after these are boiled and bleached they are dressed, *i. e.*, a brilliancy is imparted to them imitating as closely as possible the lustrous appearance of real silk. This dressing or glazing process is an industry of itself, and is obtained by depositing on the fibre a mixture, of true emulsion, varying very much in its composition according to the formula adopted by the glazier who uses a fecula in the shape of starch, and when the latter is transformed into a hot paste some greasy or waxy substance is added, such as stearic acid, white wax, or paraffine. When cold this mixture remains intimately connected, particularly if it has been stirred sufficiently while in the condition of a warm paste, after this substance is transferred to the

threads by means of brushes, and while they pass over two cylinders constantly turning, the lustre imitating silk is produced.

No. 15.—*Salmon Color with Aniline.*

Any shade may be obtained by dissolving fast red and orange separately, and then mixing to shade; the red will largely predominate; alum and sulphuric acid will work it, and glauber salts may be used to even it, or it may be worked in a soap bath.

No. 16.—*Salmon Color on Silk.*

For 200 yards:—

1½ lb. annatto

5 oz. cudbear.

For 10 yards:—

1½ oz.

4 drachms.

Boil the annatto, then add the cudbear; put off the boil, enter and winch thirty minutes; wash in two waters, and dry.

No. 17.—*Flesh Color.*

Proceed in the same manner as for salmon, only use from $\frac{1}{4}$ to $\frac{1}{2}$ of ingredients according to the depth of shade.

No. 18.—*Eosine on Silk.*

In a soap bath add the color, and then add acetic acid; commence cool and bring up to 120° F., then lift and add a little more acetic acid.



No. 19.—*Saffronine on Silk.*

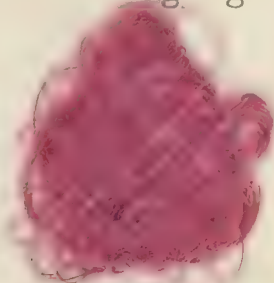
Dissolve in boiling water to which a little carbonate of soda is added. Filter the solution, and dye in a bath of water at 100° to 150° F., to which some carbonate of soda is likewise added. Wash and clear the silk in cold water acidulated with lemon juice or tartaric acid. To obtain a yellow shade use a larger amount of carbonate of soda. If the silk take the color too rapidly, add a little soap water to the bath. Preparation of the bath of sul-

phate of alumina 10° B.: Dissolve the sulphate of alumina in the water; as the sulphate of alumina of commerce always contains too little acid, it will be necessary to add some acid to the solution of carbonate of soda till the white flocculent precipitate formed redissolves again on agitating the liquid.

No. 20.—*Saffronine Rose.*

To a bath of soap add the dissolved color to shade in which a little acetic acid has been added.

The soap prevents the color going on too fast.



No. 21.—*Saffronine Pink.*

Proceed as for rose, simply using less materials.



The following new colors may be used in the same manner:—

No. 22.—*Phloxine,*

which is a shade of yellow cast similar to eosine pink or rose.

Erythrosine, a shade between saffronine and eosine.

No. 23.—*Bengal Rose,*

a bluer shade than saffronine, but not so blue as roseine. It is a very fine shade.

See phloxine and Bengal rose in wool yarn.

No. 24.—*Aniline Scarlet.*

Proceed in the same manner as for rose, only use B scarlet in place of saffronine.

No. 25.—*Flesh Color and Salmon*

can be produced in the same way by adding a little orange to shade.

The scarlet and orange here referred to are the azo colors used for wool.

No. 26.—*Scarlet on Silk* (20 lbs. organzine).

Boil for two hours with 5 lbs. curd soap. Squeeze well, and enter into the dye beck at 122° F., to which so much of the soap lye must be added as to froth. Then add

Oil of vitriol	. . . . .	8½ ozs.
Ponceau R. R. (Berlin Aniline Co.)	. . . . .	2¾ “

previously well dissolved. Enter, raise to a boil, wash, and take through weak vitriol sours, dry, etc., as usual. Before entering the silk the beck should be well skimmed, and the coloring matter should be added by degrees.

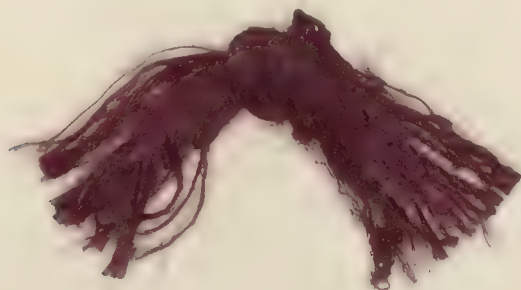
No. 27.—*Cardinal.*

In a soap bath made slightly sour add three parts wool scarlet and one part acid magenta.

For bluer shades add more magenta.

For deeper yellow shades add orange.

For heavier shades add acid claret.



No. 28.—*Scarlet with Cochineal on Silk.*

For 200 yards:—

For 10 yards:—

Bottoming preparation	{	2 lbs. annatto,	Fully $1\frac{1}{2}$ oz.
		$1\frac{1}{2}$ " tartar,	$1\frac{1}{4}$ "
		$1\frac{1}{2}$ qt. scarlet spirits,	$3\frac{1}{2}$ "
Dyeing,		3 lbs. cochineal.	$2\frac{1}{2}$ "

Bottom with annatto, 212° F., winch for fifteen or twenty minutes, and it should be a full orange. Dissolve the tartar, and put it and the spirits into 160 gallons of water. Winch in this for some time, then let it lie for twelve hours (if this preparation is made hot three or four hours will do); grind, and then boil the cochineal; put off the boil; lift out of the preparation, and enter; winch till the liquor cools, and the color will be full enough. This color may be done by giving the annatto and dyeing on the crimson vat made as follows, viz., boil one cwt. Lima-wood; decant the clear liquor into a wood or stone vessel. Let it stand till quite cold, and add 56 lbs. spirits. This vat may be renovated with killed spirits 7° Twaddle, viz., 3 gallons muriatic acid, 2 gallons nitric acid, 2 oz. sal ammoniac, feed with $3\frac{1}{2}$ lbs. of tin.

No. 29.—*Grain, Crimson Grain on Skein.*

Add to a bath of hot water three parts of nitrate of tin; work the silk for two hours, and then wash off well, and enter a bath of three pounds of cochineal; put it in a bag and fill a tub with boiling water; let it be poured through a bag in the tub so as to get all the strength out of the cochineal; enter the silk; work for one hour, then let it soak in the bath for four hours, then wring it out, then enter a clean bath of water with a small quantity of cochineal liquor added to it, which will keep the silk from dulling down.

No. 30.—*Skein, Grain Scarlet.*

Dye same as No. 28, and wash off the annatto, soap and dye, with cochineal about two pounds; dissolve, and work the silk same as No. 29.

No. 31.—*Ruby.*

It is dyed with cudbear alone; when a blue shade is required add a small quantity of ammonia; when a red shade is required add muriate of tin.

No. 32.—*Aniline Ruby.*

Any shade can be secured by dissolving separately acid magenta and acid claret, and mix to shade, and work with or without soap in an acid bath.

No. 33.—*Aniline Claret.*

Dissolve acid claret aniline, and add it to a soap bath made slightly acid, and wash to shade.

No. 34.—*Aniline Claret.*

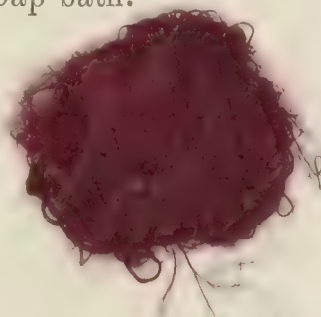
Proceed as for claret, only use with the acid claret enough orange to give the fire to the shade.

No. 35.—*Maroon.*

Proceed as for ruby with cudbear or orchil, using fustic to shade. Muriate of tin may be used to brighten it. Some alum first, and dye with hypernic, and raise with tin for the bright shades.

No. 36.—*Maroon on Silk*

can be dyed with acid aniline claret and scarlet (mixed according to shade) in a hot soap bath.



No. 37.—*Ponceau on Silk*

requires less annato on the bottom than scarlet with cochineal (No. 28), but the same quantity of spirits and tartar in preparation, and as much cochineal on dyeing.

No. 38.—*Claret on Silk.*

Prepare in a hot solution of alum for ten or twelve hours; lift and wash in two waters; boil or scald.

For 100 yards:—

For 10 yards:—

12½ lbs. Lima-wood, or peach-wood,

or Brazil-wood hypernic. 1¼ lbs.

2 lbs. logwood. 3¼ oz.

Decant the clear of both liquors into a tub of sufficient size; enter and winch for thirty minutes; air out and repeat. When dark enough wash and dry.

Note.—In dyeing this it ought to get two liquors or the liquor twice, as one will hardly make the color as full as it ought to be.

No. 39.—*Cinnamon Brown on Silk.*

For 100 yards:—

For 10 yards:—

Boil 12 lbs. fustic,

1¼ lb. nearly,

3 lbs. ground madder,

4¾ oz.

2 lbs. barwood.

3 oz.

Cool to 200° F., then enter and winch twenty minutes; air out and repeat; then with a little of the liquor in another dish sadden to pattern with 4 or 5 oz. copperas one or two shots; then wash in two waters, and dry.

No. 40.—*Mauve and Cannelle on Silk*

in the soap bath, on wool direct, and on cotton mordant with tannin.

No. 41.—*Olive Brown on Silk.*

For 100 yards:—

Boil 10 lbs. fustic,
 2 lbs. logwood,
 6 oz. cudbear.

For 10 yards:—

1 lb.
 $3\frac{1}{4}$ oz.
 $2\frac{1}{2}$ oz.

Cool to 200° F., then enter, and winch for twenty minutes; air out, repeat, then sadden to pattern with 4 oz. of copperas; wash and dry.

No. 42.—*Havana Brown on Silk.*

For a dress. Prepare a decoction of $\frac{1}{4}$ kilo. (0.5 lb.) cutch and in this bath of a temperature of 80° C. (176° F.) dissolve 20 gr. (0.7 oz.) blue vitriol, work the dress in this bath for half an hour after the same has been washed, take it out and put it into a fresh bath of 65 gr. (2.27 ozs.) bichromate of potassa, stir for a quarter of an hour, press it and pass it through another bath of sulphuric acid, then wash. A more lively color will be obtained by shading the tissue thus treated by means of a bath containing a little Bismarck or yellowish coralline called aniline orange. Then wring, pass it into gum-water, and dress on the cylinder.

No. 43.—*Snuff Brown or Giraffe on Silk.*

For 200 yards:—

12 oz. of annatto,
 4 lbs. fustic,
 8 oz. madder,
 4 oz. cudbear.

For 10 yards:—

$9\frac{1}{2}$ drachms,
 $6\frac{1}{2}$ oz.
 $6\frac{1}{2}$ drachms,
 $3\frac{1}{4}$ drachms.

Bottom with the annatto at 212° F.; wash in one water, boil the fustic, madder, and cudbear together; put off the boil, and enter; winch fifteen minutes. If not full enough air out and repeat, then wash and dry.

No. 44.—*Light Browns.*

For a good light brown, enter a bath of annatto and soap lather until a good orange color is produced; then wash off and darken in weak copperas, wash off, dye with archil and fustic; all the light shades can be made in this manner.

No. 45.—*Dark Brown.*

Prepare with annatto, same as above; sadden with stronger copperas, and dye with archil, logwood, and fustic.

No. 46.—*Olive Brown.*

Put on a strong annatto bottom at boiling point, and wash off; then add clear fustic according to shade and a little sumac liquor with it, then darken in cold water with copperas and argol; if the shade is very yellow, add turmeric with the fustic.

No. 47.—*Claret Brown.*

Proceed as for No. 44, but use no fustic with the archil; if required very dark, a body of logwood can be given before or with the archil.

No. 48.—*Seal Brown.*

Bottom to a wine color with archil, then full to shade with serge blue and turmeric. Bird's cotton seal brown will dye silk well in one bath.



For 200 yards :—

1½ lb. barks,

1 pint muriate of tin.

For 10 yards :—

1¼ oz.

1½ oz.

Scald the bark, decant the clear, add the muriate of tin; enter and winch fifteen minutes, then wash in two waters, and dry.

No. 50.—*Phosphine Yellow.*

Will dye on wool direct.

On silk in a soap bath.

Prepare in aniline mordant for cotton.

No. 51.—*Tropaeoline Yellow.*

Will dye on wool with sulphuric acid or tartar.

On silk in soap bath.

Prepare in stannate, and then in tannin, for cotton.

N. B. In all cases when acid anilines are to be dyed on silk in soap, it must be understood that enough sulphuric acid has been added to curdle the soap.

No. 52.—*Yellow on Silk.*

For 200 yards:—

3 lbs. barks,

1½ pint muriate of tin.

For 10 yards:—

2½ oz.

2 oz. fully.

Done in the same manner as primrose (No. 49).

No. 53.—*Straw on Silk.*

For 200 yards:—

8 oz. annatto,

1½ lbs. barks,

1 pint muriate of tin.

For 10 yards:—

6½ drachms,

1¼ oz.

1½ oz.

Give the annatto on the bottom 212° F.; one water out, and then give the barks and muriate of tin same heat.

Note.—Before using annatto it must be boiled with half its weight of American ashes in the least possible quantity of soft water. This note applies to every process where annatto is used.

No. 54.—*Orange on Silk.*

For 100 yards:—

2¼ lbs. annatto,

1½ lbs. bark,

1 pint muriate of tin.

For 10 yards:—

1¾ oz.

1¼ oz.

1½ oz.

Give a good body of annatto 212° F.; wash in one water, then top with the bark and muriate of tin.

No. 55.—*Amber on Silk.*

For 200 yards:—

1 $\frac{3}{4}$ lbs. annatto,1 $\frac{1}{2}$ lbs. bark,1 $\frac{1}{2}$ pints muriate of tin.

For 10 yards:—

nearly 1 $\frac{1}{2}$ oz.1 $\frac{1}{4}$ oz.

2 oz.

Bottom with the annatto, and top with the bark and muriate of tin, same as orange (No. 54).

No. 56.—*Buff on Silk.*

For 200 yards:—

2 lbs. of annatto,

3 gills vitriol.

For 10 yards:—

fully 1 $\frac{1}{2}$ oz.1 $\frac{1}{2}$ oz.

Give the annatto at 212° F., when full enough lift, wash in two waters, then raise with the vitriol.

No. 57.—*Yellow.*

This color is dyed in the following manner: Enter the silk in a bath of nitric acid; work for half an hour, then enter a bath of soda ash; work half an hour in the bath hand-warm, and wash off well.

No. 58.—*Another Way.*

Dissolve in a vessel six pounds turmeric; strain off the clear liquor; add it to a clean bath of water at boiling point; enter goods; work half an hour, and add to the same bath three pounds of alum; work half hour, and wash off.

No. 59.—*Orange Color.*

Dissolve soap, and let it come to a lather, and add to it the solution of two and a half pounds of annatto which has been previously dissolved with ash solution; work until it is the shade required, and then wash off well.

No. 60.—*Aniline Primrose or Yellow.*

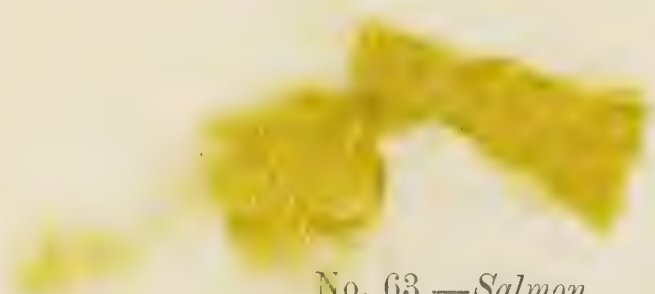
A beautiful shade is produced with the new acid primrose in a soap bath or without, and worked in with simply sulphuric acid.

No. 61.—*Aniline Yellow and Amber.*

Can be dyed equal to flaveine or annatto, if not superior, by using acid yellow or acid amber; dye with acid.

No. 62.—*Aniline Old Gold Color.*

Dissolve separately acid amber, acid brown, and acid green, only a little brown and less of green is required; it is dyed like No. 60.

No. 63.—*Salmon.*

Dyed like No. 60, with scarlet and a trifle of acid orange.

No. 64.—*Flesh Color.*

Use $\frac{1}{4}$ or $\frac{1}{2}$ the amount of scarlet and orange as required for salmon.

No. 65.—*Aniline Orange.*

Dye to shade with acid orange on a soap bath with sulphuric acid. It will dye without the soap if desired. Redder shades can be got by adding aniline scarlet, or yellower shades by adding turmeric or acid yellow.

No. 66.—*Sky Blue from Prussiate.*

Enter a bath of nitrate of iron about 1.2° Tw.; work the silk half hour; then enter a bath of clean water with one quart of ammonia added to it; then enter another bath with the solution of two pounds of prussiate added to it; work half hour; lift out and add one pint of vitriol to the same bath: work half hour in this and wash off.

No. 67.—*French Blue.*

Give about half hour in a nitrate-iron bath at 5° Tw.; then let the silk steep in it another half hour; then wash and wring out; then enter a bath of common soda water, have the bath hot; then wring out; enter a bath of prussiate, without washing, where three pints of muriatic acid have been added; work in this bath forty minutes. It will then appear a dull color; then it should be raised in a bath of ammonia; to four gallons of water add one pint of ammonia; work half hour at hand-warm.

No. 68.—*Royal Blue.*

Work one hour in a bath of nitrate of iron 6° Tw. with two pints of muriate tin added to it, and five ounces of tartaric acid; then wash off iron and enter another bath with the solution of two pounds of prussiate and half pint of vitriol added to it; repeat iron and prussiate twice; then enter a weak bath of vitriol, half pint to thirty gallons of water, to cut off all rust, which is apt to be on it.

No. 69.—*Sky Blue with Indigo.*

Dissolve extract of indigo, and strain it; then add a little by degrees into a vessel containing water at 100° F., to which have been added alum and sulphuric acid, just a little sharp to the taste; raise to 200° F.

No. 70.—*Sky Blue.*

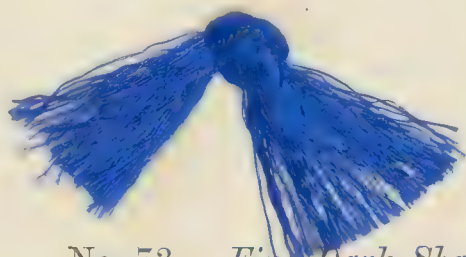
From soluble aniline china, opal, pure blue, or almost any of the fine blues will work on silk. The proportions of four parts alum and four parts sulphuric acid to one part of aniline will be found to give good results; commence at about 100° F. and slowly raise to 200° F.

No. 71.—*Light Blue from Cotton Blue.*

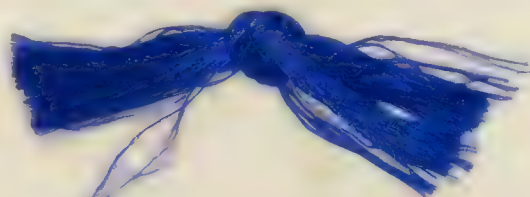
For ten pounds add one ounce of dissolved color to a cold bath, and a small quantity of sulphuric acid; gradually raise to 160° F., then wash off.

No. 72.—*Medium Shade.*

For ten pounds proceed as for No. 71, only use three ounces of aniline.

No. 73.—*Fine Dark Shade.*

For ten pounds use three ounces cotton blue, as No. 72, and work in the same manner for half hour; then lift, and add 1½ oz. 4° B. violet to the same bath; work half hour, and wash off.

No. 74.—*Methyl Blue on 20 lbs.*

In a soap bath add three ounces color and 1½ pounds sulphuric acid; for dark blue use double the quantity of color; commence at 100° F. and raise to 200° F.; then wash and pass through a weak sour.

Some use it in the same way as alkali blue, dyeing with borax and raising with acid.

No. 75.—*Nicholson or Alkali Blue.*

Dye in a borax bath to which add some soap. The quantity of color depends entirely upon the shade required: as for twenty pounds of silk one ounce will suffice for a pale sky, while from six to ten ounces will be required in very dark. They should be entered at 100° F. and not exceed 200° F. The depth can be ascertained by taking a small piece and dipping it into a weak sulphuric acid. When deep enough pass it through a sulphuric acid just sharp to the taste.

For the light shades take the higher number of Bs.

No. 76.—*Benzole Blue on Silk (20 lbs.).*

Prepare with soap, but the dye-bath must be at 140° F. It contains

Acetic acid	8½ ozs.
Benzole blue	3¼ “

The color must be previously well dissolved and added by degrees; dye whilst the temperature is raised to a boil; wash, and take through weak acetic acid sours, and dry.

No. 77.—*Serge and Navy Blue.*

Serge blue is dyed with sulphuric acid. Navy blue with serge and induline or indigo extract to darken.

The pattern shown was dyed with serge blue and extract of indigo, worked with sulphuric acid.

I have dyed a very dark blue, resembling black, with induline and sulphuric acid, so fast that alkali or acid did not perceptibly affect it.

No. 78.—*Methyl Green Silk.*

Dye in a soap bath, and raise with acetic acid; on wool mordant in hyposulphite of soda and then in muriatic acid, wash and

dye alone ; on cotton mordant with tannin, or tannin and tartar emetic.

No. 79.—*New Victoria Green and Brilliant Green.*

On silk in the soap bath ; on wool with a little cake alum or prepared tartar ; and on cotton mordant with tannin, or tannin and tartar emetic.



No. 80.—*Light Green with Acid Green.*

On silk in a curdled soap bath ; on wool with sulphuric acid.

No. 81.—*Pea Green for Silk.*

For 100 yards :—

10 oz. extract of indigo,

$2\frac{1}{2}$ lbs. ebony,

1 lb. alum.

For 10 yards :—

1 oz.

4 oz.

$1\frac{1}{2}$ oz.

Sour first ; wash in one water ; boil or scald the ebony ; decant the clear, and add the extract of indigo and alum ; enter in this, and winch for ten or fifteen minutes ; wash in one water.

No. 82.—*Grass Green on Silk.*

For 100 yards :—

Boil $7\frac{1}{2}$ lbs. fustic,

Add 2 lbs. extract of indigo,

2 lbs. alum,

$1\frac{1}{2}$ gill sulphuric acid

For 10 yards :—

12 oz.

3 oz. 3 drachms,

3 oz. 3 “

$1\frac{1}{2}$ “

Boil the fustic first ; then add the extract of indigo, alum, and acid ; put off the boil ; enter and winch till you get the shade required. If not blue enough, give more extract of indigo. If not yellow enough, more fustic.

No. 83.—*Olive Green for Silk.*

For 100 yards:—

10 lbs. fustic,
2 lbs. logwood,
10 oz. camwood,

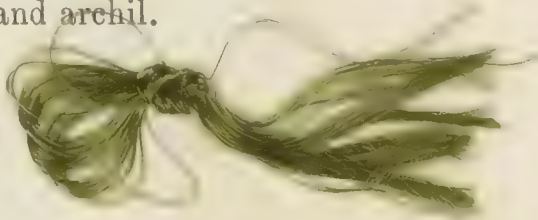
For 10 yards:—

1 lb.
3 oz. 3 drachms.
1 oz.

Boil all together for thirty minutes; put off the boil; enter and winch for twenty minutes; air out and repeat; sadden with three or four ounces of copperas in the same liquor in another part of bath. When the required shade is obtained, wash and dry.

No. 84.—*Olive.*

Give a light blue bottom and dye off at boiling point with turmeric liquor and archil.

No. 85.—*Bottle Green and Aniline Olives.*

This bottle green was dyed first an archil bottom to a full wine color. Second bath topped off with aniline green. All of these shades can be obtained by the following ingredients proportioned according to the shade required: Acid yellow, acid green, acid orange, acid brown, and induline or extract of indigo for the dark shades.

No. 86.—*Aniline Light Bronze.*

All the prevailing shades can be got from separately dissolving, and then mixing to shade either acid primrose or acid amber with acid green and brown or archil in place of brown.

No. 87.—*Aniline Dark Bronze.*

More of the acid brown and green are required than for light bronze, and archil or induline may be used with it if the shade require it.

The last three receipts are worked on with acid.

Any of the above I have mixed to shade by request at a fair price.

For malachite and other greens, see the woollen list, many of which formulas will do for silk.

No. 88.—*Drab on Silk.*

For 100 yards:—

Boil 4 lbs. fustic,
and 6 oz. logwood,
2½ oz. cudbear,
1¼ oz. copperas,

For 10 yards:—

6½ oz.
½ oz. fully,
¼ oz.
2 drachms fully.

Cool to 200° F.; enter; winch twenty minutes; air out, and repeat; then take a little of the liquor out of the boiler; dissolve the copperas; reduce it to handling heat with water, and give one or two shots through it as the pattern requires; one water out of the saddening; then give a warm but weak sour to clear the color; wash in two waters and dry. This will make bottom for all dark colors; if repeated in the mordant after a wash from the iron it will darken it much.

Note.—Before using cudbear, it must always be drenched with a little hot water to the consistency of paste; then scald or boil it as occasion may require.

No. 89.—*Fawn on Silk.*

For 100 yards:—

4 lbs. fustic,
5 oz. cudbear,
1½ oz. copperas.

For 10 yards:—

6½ oz.
½ oz.
1½ drachms.

Done in the same manner as drab (No. 88).

No. 90.—*Stone on Silk.*

For 100 yards:—

3 lbs. fustic,

7½ oz. logwood,

2½ oz. cudbear,

2 oz. copperas.

For 10 yards:—

nearly 5 oz.

¾ oz.

¼ oz.

nearly ¼ oz.

Done in the same manner as drab (No. 88).

No. 91.—*Slate on Silk.*

For 100 yards:—

8 oz. cudbear,

2 lbs. logwood,

1 lb. tartar.

For 10 yards:—

1 oz. nearly,

3 oz. and 3 drachms,

1½ oz. fully.

Boil the cudbear and 'logwood; put off the boil; enter; winch for thirty minutes; lift, and raise with the tartar at once, then wash and dry.

No. 92.—*Lavender.*

To dye lavender on ten pounds of silk, make up bath of warm water and add to it the solution of one quart of extract of indigo and a small quantity of magenta according to the redness or blueness of the shade required on the goods.

No. 93.—*Another Way.*

First enter a hot bath of water with enough cudbear to redden, then blue it to the shade in a second bath with extract of indigo in it.

No. 94.—*Mauve.*

In a soap bath add a little acetic acid, and dissolved aniline to shade. 1 B. was used for this pattern; for bluer shades use 4 to 6 B.



No. 95.—*Plum.*

To a soap bath add equal parts of acid claret and violet; work with acetic or sulphuric acid.

No. 96.—*Wine Color*

Is dyed in the same way as plum, by adding acid orange to shade it.

No. 97.—*Jet Black with Nitrate of Iron on Silk (200 yards).*

After being cleaned, prepare in a cold bath of nitrate of iron, 5° Tw., which is strong enough for light silks; 4° to 4½° will do for dark colored; let lie in half an hour; wash well; boil fourteen pounds fustic, put off the boil, and winch half hour. Then boil sixteen pounds logwood, stop the boil, and add soap sufficient to produce a good lather, and winch to shade.

When soap is used on black silk it does not require to be washed, but in all cases to be hung up as soon as drained quite open, that is even, and dried in a hot stove.

No. 98.—*Real Paris Black on Silk.*

Take three parts of fustic, one part of bark liquor, two ounces of verdigris, one ounce copperas, to every pound of silk, in water at 180° F., steep the silk in all night, in the morning wash twice. Dye with logwood, and soap at 150° F., varying strength of logwood by depth of black required, then soften in soda and neatsfoot oil. This is a first-rate black.

No. 99.—*Black on Silk with Extract of Chestnut.*

A good full cheap black can be got in this way. For 10 pounds silk take 350 pints of natro-chloride of iron at 17° Tw., steep for twenty-four hours, turning occasionally; wash well (nitrate of iron will do in place of the former). Dye with 175 pints extract of chestnut and 105 pints of hot water for one hour. Then in a liquor of 10 pounds logwood, in which is 17½ ounces white soap at 194° F., till good black. Then rinse in 7 ounces ammonia water; then in seven ounces acetic acid water.

No. 100.—*Black Silk Dyeing, for Jobber Dyers.*

All drab silks, and those that are likely to be sumached, are given a boiling in soda water, and rinsed in one water; then pass them for a few minutes through hot nitric-acid bath which gives them a yellow bottom, and at the same time strips off old color. Rinse through two waters, one cold, the other hot, and lay down in nitrate of iron bath for one night. Rinse well out of this in three waters, and pass through your decoction of logwood and oil soap to shade; finally pass them through a warm soap liquor to clear, and dry in a hot stove. The hotter they are dried the better they look. For jet shades use 4 parts logwood, 1 part fustic in the soap; some keep the nitric acid for further use in stone jars; as it takes 1 pint to 1 gallon of water, the same will do several times.

No. 101.—*A Bluish Black on Silk Velvet.*

For 1 kilo. (2.2 lbs.). Make a decoction of ½ kilo. (1.1 lb.) prepared cutch and 80 gr. (2.8 oz.) crystallized soda, let this settle, immerse the velvet and work it in a bath heated to 140° F., then work it for two hours cold, take it out again, wash, and let it drip off. Add a little soap, introduce it into a bath of 1 kilo. (2.2 lbs.) prussiate of potash, press it and put it again in the iron bath, treat the same as before, wash, and go with it once more into the potash bath in order to wash with soap in a bath containing 375 gr. (13.12 oz.) castile soap to 50 litres (13.2 gal.) of water. If the velvet has been dark before, the bluish black would thus be finished, but if it chances not to be of a black deep enough,

prepare a warm bath containing a decoction of $\frac{1}{2}$ kilo. (1.1 lb.) logwood and 150 gr. (5.25 oz.) castile soap, dye until the proper tint shall have been reached; take it out again, wash, gum, and evaporate.

No. 102.—*Jet Black from Nitro-Sulphate of Iron for Silk.*

For 200 yards, or 16 pounds, prepare in a hot solution of nitro-sulphate of iron, 5° Twaddle (150° F.); work thirty minutes in this; lift, and wash well in three warm waters, then boil 18 pounds of fustic, put off the boil, enter and winch for thirty minutes; lift, boil 16 pounds of logwood, put off the boil, and decant the clear liquor into a large tub, add 1 pound of white soap; enter and winch for thirty or forty minutes in this; lift, wash in two waters, and you will have a brilliant jet black.

No. 103.—*A New Mode for Dyeing Black on Silk.*

This process is performed by pure nitrate of iron, basic, and neutral acetate of lead. Instructions respecting this new mode of dyeing are given in Dingler's Journal, as follows: The bath for the neutral acetate of lead is prepared by dissolving 20 pounds of litharge (protoxide of lead) in 4 to 5 pounds of pyroligneous acid and as much water until the clear liquor shows at 104° F., 44 to 45 Bé scale for neutral acetate of lead. It is only necessary to use a little more pyroligneous acid. For the preparation of nitrate of iron new scrap iron has to be dissolved in nitric acid. The silk which is to be dyed, after it has been previously well boiled and washed, is to be put into the bath containing the nitrate of iron, and worked about for fifteen minutes; then lifted out and exposed to the air for a short time to oxidize the iron, and afterwards washed in water, when the olive-green color turns into a rusty yellow. Treat the silk twice in exactly the same manner; prepare a logwood bath, add to it a little quercitron or fustic liquor; heat it up to about 86° F., and add to this a small quantity of blue vitriol (sulphate of copper) previously dissolved. In this bath the silk prepared with the iron is put, and worked from twenty to thirty minutes, until quite even, after which it should be allowed to remain in the bath for some time. The silk has now lost its weight, and has to be washed

again in water, and afterwards to be put into a tub containing water, to which is added olive oil that has been previously saponified with a little soda. In this liquor the silk is to be worked for a few minutes, after which it has to be well wrung, the object of this last bath being to give the silk a nice soft feeling. The silk is then taken to a bath containing the basic acetate of lead, which has been heated to about 144° F., in which it is well worked about and left in for some time. This operation will give weight to the silk, but will rather weaken the appearance of the black. To reproduce the full brightness and purity of the black the silk has lastly to be treated in the following manner: When it comes out of the basic acetate of lead bath it wants wringing out well, and, if possible, pressing, in order to free it as much as possible of liquor. This silk is then slowly dried at a gentle heat in a close room in which there is a good supply of sulphide of hydrogen gas. When this process is carefully performed it produces a most beautiful and soft black, and will be quite as fast as that which is produced from galls.

No. 104.—*Rose on Bleached China Grass* (30 lbs.).

Dissolve sulphate of soda crystals 3 lbs.

Erythrosine, or eosine (Monnet & Co.) $1\frac{1}{2}$ oz.

Enter the goods at 99° , raise the temperature gradually to 131° F., wring out and dry.

It is well to enter the solution of color by degrees in two or three parts.

No. 105.—*Methylene Blue on China Grass* (30 lbs.).

Make up a bath of curd soap and add methylene

blue, No. 1 $\frac{7}{8}$ oz.

Enter at 130° F., give five or six turns, add $8\frac{1}{2}$ oz. sulphuric acid, and turn well, raising the heat to 158° F.; wash, and take through a water very slightly soured with sulphuric acid.

No. 106.—*Method for Dyeing Shots.*

When satins, satinets, sarsenets, or silks of any kind are found to contain shots—that is, warp and weft of different qualities—they must be prepared as follows:—

For 100 yards dissolve $1\frac{1}{2}$ lb. salt of tartar in a copper containing 150 gallons boiling water; winch in this one hour; lift, and wash in two waters; and then prepare for any color; if, after dyeing black, brown, and orange color, the silk is found to contain a shot of different silk it must be discharged to the bottom, and put through the stuff as directed above; then prepare anew for whatever color required.

No. 107.—*Violet*

(soluble in spirit) is dyed on silk in a curdled bath of Panama bark; on wool with prepared tartar; and on cotton with tannin and tartar emetic.

No. 108.—*Stiffening Silks.*

All light silks are better finished up with half gum and half glycerine. It gives body and brilliancy, and has not the unpleasant rattle of glue. Black silks may with advantage be finished in the same way.

No. 109.—*Finish for Silk Handkerchiefs.*

The pieces are pulled upon wooden cylinders traversed by an axle, and arranged so that they may be fitted upon the machine. Each roll is of 56 handkerchiefs.

When rolled up they are passed at great speed through cylinders heated by irons made red hot and placed in the same.

After this they are finished on copper cylinders, heated by steam; with the mixture No. 5 for madder work, No. 1 for steam work, which mixture is placed in the trough of the cylinder. The pieces are then pressed.

No. 110.—*Finishing Mixtures for Silk.*

No. 1. Farina 7 oz. boiled, to which is then added salts of sorrel $\frac{1}{2}$ oz., best hide glue 2 lbs. 3 oz.; strain the whole.

No. 2. Starch 4 lbs. 6 oz. in 7 quarts of water.

No. 3. White Marseilles soap 17 oz. in $3\frac{1}{2}$ quarts of water.

No. 4. Best white glue $3\frac{1}{4}$ lbs. in 27 quarts of water.

Gums are also used, as are glycerine and white sugar, to give body and glaze.

The same mixtures or stiffenings are used for piece silk and ribbons.

Considerable body can be attained with gum and glycerine, without the objectionable harsh rattle of glue.

THE WEIGHTING OF SILKS.

Silk that has to be sold by weight is so weighted in the process of dyeing and finishing that 30 pounds may be made to weigh about 100 pounds. It may not be often that it is burdened to this extent, but it is a fact beyond dispute that very large frauds are carried on in its adulteration. Mixtures in some things have a compensation of some kind and on that ground are justifiable, but in this case the jobber, if he cares for good, regular custom, is not benefited; the wearer is not benefited; the warehouse that holds it, or the ship that carries such combustible goods, is not benefited by it, neither is the insurance office. Who is then? Only the manufacturer; and not he, if he cares for reputation or has any conscience. I therefore refrain from giving the information which some may suppose should have been given, with this advice—go, and sin no more.

Note.—Since writing the above, the following excellent article upon this question has fallen into my hands. I have pleasure in giving it a place here.

THE WEIGHTING OF SILK.

One of the most infamous adulterations lately resorted to in Europe for the purpose of swindling the silk consumer is the weighting of silk by means of chemical preparations liable to ignite. When the subject was for the first time brought to public notice a year or two since by some cases of black silk taking fire spontaneously, there was an outburst of indignation throughout the press, and the Dry Goods Bulletin and Textile Manufacturer made some suggestions at the time. Since then the subject has slumbered, and will probably remain forgotten by the general public until some new accident startles it by the inflammable substance in a box of European silk catching fire and spreading a conflagration on board some vessel or in a warehouse, involving the loss of life, perchance,

as well as of millions of dollars. The *London News* of July 30 takes up the subject again, and we are glad of it. It expresses itself to the following effect:—

“In the report of Sir Edward Thornton, lately Minister at Washington, and now Ambassador at St. Petersburg, attention is drawn to certain mysterious fires both in warehouses and on board ship, which, after careful inquiry by a police committee and a board of underwriters in New York, have been traced to consignments of black silk. The immediate cause of danger is, it appears, the chemical materials now used to give weight as well as improved color to the silks. The art, says the report, has reached such perfection that the weight of the natural silk can be increased four-fold without apparent adulteration; but the minerals, vegetables, acids, and alkalies thus used, combined with animal substances and the natural germ of the silk, constitute a fermentable compound which generates carbonization or combustion under pressure, confinement, and heat. That the black silk goods have ignited spontaneously from these causes and caused serious fires is considered to be abundantly proved by the evidence.”

In future American consuls should be instructed from Washington to certify no invoice of silk shipped from Europe, unless the same be accompanied by a certificate of chemical test that it is not weighted with any substance whatever. This will put a stop to the fraud. Steamship companies, owners of sailing vessels, insurance companies, and the public at large are all equally interested in killing this unpardonable fraud at the very root. This cannot be done except by insisting upon a “certificate of harmlessness” which will besides protect the *bona-fide* manufacturer, both abroad and here; for no honest manufacturer can compete with silk thus adulterated, not to speak of the consumer who is the final and chief victim of similar frauds upon the community.

HOW TO TEST THE QUALITY OF SILK.

How to determine the actual quality of silk is a question that often puzzles the feminine mind. A sure plan is to take ten fibres of the filling in any silk, and if on breaking they show a feathery, dry, and lack-lustre condition, discoloring the fingers in handling, you may at once be sure of the presence of dye and artificial

weighting; or take a small portion of the fibres between the thumb and forefinger, and very gently roll them over and over, and you will soon detect the gum, mineral, soap, and other ingredients of the one and the absence of them in the other. A simple but effective test of purity is to burn a small quantity of the fibres; pure silk will instantly crisp, leaving only a pure charcoal; heavily-dyed silk will smoulder, leaving a yellow, greasy ash. If, on the contrary, you cannot break the ten strands, and they are of a natural lustre and brilliancy, and fail to discolor the fingers at the point of contact, you may well be assured that you have a pure silk that is honest in its make and durable in its wear.

SOMETHING ABOUT THE CRACKLING NOISE OR THE TOUCH OF SILK.

The crackling noise which is noticed in the turning or pressing of silk, is not a quality which it has naturally, but has to be produced artificially. The same colors on silk can be produced at will, crackling or not. It is therefore neither the color nor the fibre which gives the touch of the silk. As manufacturers consider it of value to have the silk show this peculiarity, it is of great importance to the dyer to know by what process this crackling can be produced. Touchy or crackling is found to be produced on silk which has received a scouring in the last, or before the last, bath. The silk will not be so if the last bath has been soapy or alkalinous, or if it has passed a neutral bath. If this quality of the silk, therefore, is wanted, it is necessary to give it, either before or after dyeing, a sour bath, either by free acids or by sour salts.

Now, I might ask, how is this crackling noise explained?

Silk, free from gummy substances, which contains, besides the pure fibre, only albuminous matter, is easily made touchy or crackling by very diluted acid baths. I explain this noise in this way: the acid baths effect a change on the albuminous substances in the silk, probably they coagulate them, and thus cause a change of the material.

DRYING SILK GOODS.

Messrs. Guinon, Fils & Co. propose the employment of the vacuo for drying silk goods very rapidly without a hydro-extractor. The skeins or pieces are brought into a metallic chamber heated by means of steam, by a coil at the bottom and a false cover at the top, and the goods suspended on sticks by a proper arrangement. The chamber is perfectly tight, and is in communication with an air-pump. When the silk is taken out of the dye-bath and washed, it is put on sticks and put in the chamber, where it is rapidly dried by the action of the heat and vacuum combined. It is claimed for this method greater economy in time, labor, and other expenses, beside preventing any soiling of the silk. According to Mr. Moyret the application of the vacuum for drying fibres or fabrics is not a new idea, but it has been used for desulphurizing silks which had been exposed to sulphur for bleaching.

SPINNING SILK WASTE AND VEGETABLE FIBRE.

Messrs. Agache & Imbs have patented in France the following method: By mixing long-stapled vegetable fibres with silk offals, the disadvantage occurs that the former dye badly, whereby a difference in the color is produced as well as an inclination to lose its color. By the mode of procedure of these gentlemen this defect disappears, if before mixing and spinning the vegetable fibres are submitted to the following process: They are steeped in an emulsion of animal oil with a solution of soda, then put in heaps until fermentation ensues. The fibres thus are mordanted, and when mixed with the silk offals, they are treated in the spinning like flax, either dry or wet.

TO IMPROVE RUSTY SILKS.

Job dyers having to contend with different old colors and plaid silks, often find when they are dyed that some are too bronzed or

rusty to finish. Passing them through oil soap hot, and not rinsing them, but drying them open in a hot stove has a good effect. Another way is to pass them through a little sour, and rinse ; or they may be finished with new milk sponged on when finishing.

SECTION II.

BLEACHING WOOL, COTTON, LINEN, ETC.

No. 1.—*Bleaching Wool.*

IN quantities of 100 pounds the process is very simple. The scourer should have care that the kettle is not hotter than 132° F., and that the wool does not lie in the bath long enough to become yellow. The goods or yarn are scoured in clean soap as usual, and then hung up in a closed chamber or bleach-house exposed to the vapor sulphurous acid, produced by burning in an iron pot six or more pounds of brimstone. When yarn is bleached for the market it should be put into the sulphur-house without the soap being rinsed out—only switched out well. If the white has to be colored, the wool should first be run through a cold bath containing two pounds muriate of tin, two ounces of extract of indigo, three ounces of cochineal paste, red, blue, and yellow form white, and the wool is naturally yellow, hence the method of treatment. Then take the wool into the sulphur-house. The fabric ought never to be colored after sulphuring, as it will become spotted. Carpet yarn may be afterwards run through a bath containing five pounds of whiting; this somewhat neutralizes the offensive odor. Care should be taken in bleaching part cotton goods when poles or slats are employed. The wood absorbs sulphuric acid, and will rot the cotton if in contact with the cloth. The poles should be often washed or planed.

No. 2.—*Wool Bleach.*

To every 100 pounds of wool are added five pounds of bisulphate of soda dissolved in water, and two pounds of hydrochloric acid. The well-washed wool is placed in this strong solution of sulphurous acid, and left five or six hours, being stirred or moved in the usual manner. The bleached wool is now put in the

bluing bath, which also serves to rinse in. Woollen yarn can also be drawn through a solution of bisulphite of soda, and afterwards through dilute muriatic acid, which thus liberates free gas.

No. 3.—*Bleaching Wool without Stoving.*

The wool is well scoured and washed. Dissolve 11 pounds crystal bisulphate of soda and add 4 pounds 6 ounces muriatic acid in a cistern large enough (made of white wood) to well work the wool. Into this enter the wool, and turn it several times for six hours; then lift, and drain. It is then blued to shade with chemic or ultramarine blue.

Half the above proportions will do for other lots done at the same time.

No. 4.—*An Excellent Method to Bleach 22 lbs. Wool.*

Three-quarter fill the beck of the proper size with water; add $4\frac{1}{2}$ pounds of spirits of salts; stir up, and enter the well-cleaned wool which has previously been sprinkled very openly and regularly with 11 pounds bisulphate of soda in 20 gallons of water. This creates a sulphurous acid in the midst of the whole, effecting a powerful bleach in the most direct manner; blue to shade.

The same acid bath does for future use.

The wool is similar to brimstone bleached, but has far less smell, and no fear of injury in the process.

No. 5.—*White on Wool.*

Clean in soap or soap and sal soda at a temperature not exceeding from 120° to 130° F.; well wash.

Make up a curd soap bath at $2\frac{1}{2}^{\circ}$ Tw., tint it with indigo, and the bluest shade of violet, which have both been finely filtered.

Hold the liquor up, and as it falls see if the shade is as you require it; if so, enter, and turn rapidly until it is white and even, when it is at once wrung dry, and then suspend it two hours in the sulphur stove. It is then spread out in the air to dry.

If it has a scent of sulphur pass it through a bath containing a little ammonia.

No. 6.—*To Wash White Wool Goods without their turning Yellow in the Process.*

Use white soap to which has been added some dextrine in solution. Do not exceed a gentle hand heat. Wash in clean water, and if for a pure white dry in the stove.

No. 7.—*To Bleach New or Old White Goods.*

The same plan will be pursued as in the last, only let the goods be washed in just enough of the bisulphate liquor in a cistern to wet them through, and then drain, when you can blue to shade.

No. 8.—*Thallab's Bleach for Wool.*

Scoured wool is taken through a beck in which about 12 grains of indigo are used to 22 gallons of water; next through a solution of hydrosulphate of soda 4° B., then add acetic acid 5° B., and again run through the same bath; 35 fluidounces of the hydrosulphate of soda are required for 300 grains of acetic acid.

The wool is now exposed to the air, then wash in weak soda, and then in clean water and dry at 95° F.

The indigo, which was at first only a deposit on the fibre, is by the hydrosulphate of soda reduced to white indigo, and precipitated on the fibre as indigo blue. The tint is therefore permanent.

No. 9.—*The Latest to Bleach Wool.*

(Translated from the *Teinturier Pratique*.)

Take 1 kilo. (2.2 lb.) of oxalic acid to 100 litres (26.4 gals.) of water and $\frac{1}{3}$ litre (0.7 pint) of hydrochloric acid (sp. of salts). After immersion of six hours, drip off, and wash several times; the last wash should have in it $\frac{1}{4}$ litre (0.5 pint) of glycerine to 100 litres (26.4 gals.) of water slightly blued. Dry by stove or air. Tartaric or acetic acid may be used in place of the oxalic.

No. 10.—*Dyeing Wool White.*

The handsome Berlin white so celebrated, is produced in the following manner: For 5 kilos. (11 lbs.) of wool. Scour the wool carefully at a temperature of 40° to 60° C. (104° to 140° F.) in

a bath of soda-salt or soap, or, better still, with a mixture of both; then wash thoroughly; thereupon blue with a soap solution of castile soap 2° B., and a little superfine indigo carmine and very bluish methyl violet. These blue and violet solutions should be carefully filtered ere they are added. In a china cup we can easily discover whether the white is blued to the precise point required. The wool is then put into the bath and rapidly worked, and then washed in a turbine immediately, so as to prevent unevenness of coloring. The wet wool is then suspended in the sulphuring room for two hours, then hung out in the open air and dried. Should a smell of sulphur adhere to the wool it is treated with a solution of 10 gr. (0.35 oz.) of ammonia to the litre (2.1 pints) of water through which it is passed. This method is used by nearly all German dyers and bleachers.

No. 11.—*A New Process for Bleaching.*

In the *Teinturier Pratique*, M. Allion publishes a new method for bleaching fabrics. Instead of sulphur he uses bisulphate of magnesia. To increase the dissolubleness of this salt he uses a solution of a certain quantity of sulphate of aluminium. The latter acts as a weak acid to dissolve the bisulphate slowly while forming a sulphuric acid. This process is said to be very effective.

No. 12.—*Bleaching Piece Goods. Kent's Process.*

Mr. Kent, of Moscow, Russia, and of Nottingham, England, has patented an improvement in cleansing and bleaching much used by cleaners working on a small scale. The improvement consists in subjecting the cotton yarn or fabric to the following process:—

Lime and soda are mixed (in the proportion of about two pounds of carbonate of soda to one pound of lime) with water, and allowed to stand to settle, when the clear liquor is drawn off or separated from the solid matters. It is found that the strength of the liquor when used should mark about 1½° of Twaddle's hydrometer; a strength of 1½° is found sufficient for fine light goods, and for heavier goods a greater strength is required. The yarn, thread, or fabric, or other preparation of vegetable fibres is steeped in this liquor for from thirty to fifty minutes, more or less as the case may require. Fine goods require about thirty minutes, and stouter

ones a longer time in proportion. The process of cleaning and bleaching is then finished in the ordinary manner by washing, and then treating the fibrous materials with dilute sulphuric or hydrochloric acid and chloride of lime; but this part of the process requires less time, by reason of the fibrous materials not having been boiled for a great length of time with crude materials. A workman will readily judge of the effect produced, and he will find that it is not necessary to retain the yarns or fabrics in either of the liquors more than from forty to fifty minutes. By these means ordinary bleaching is accomplished in a few hours instead of occupying days. When the fabrics are to be dyed with madder, in order to render them suitable to be so dyed, or as it is commonly called "madder bleached," the fabrics after being steeped and prepared as explained, are boiled for two or three hours in a weak solution of carbonate of soda and resin. The greasy matters are formed by the lime into a sort of insoluble soap easily removed by the after process. "Scouring" removes all excess of lime, and breaks up the insoluble lime soap. It still leaves the grease upon the cloth, but in such an altered state as to be easily removable by the subsequent "bowking." Hydrochloric acid is sometimes employed in this souring, but very dilute vitriol may be used. The hydrochloric acid sours are used cold, and at a strength of 3° Twaddle. The bowking or boiling with alkali and soap dissolves and removes all grease and dirt from the cloth, leaving the cotton nearly pure. The alkali employed is soda ash; the soap, is made from prepared resin, and having the specific effect of improving the whites during the subsequent process of dyeing. The boiling need not be so long as the dyeing; the time required, however, depending upon the size of the kier and the number of pieces. The last process, that of passing through a clear solution of bleaching powder, destroys the slight buff or cream-colored tinge still adhering to the cotton. The solution of bleaching powder is so weak that an ordinary sized piece of calico does not probably take up more than a quarter of an ounce soluble matter contained in it. The goods are allowed to remain some time with the chloride of lime in them, and are finally passed through sours to complete the operation. The acid sets the chlorine free from the bleaching powder, and completes the destruction of the color, at the same

time removing the lime, and acting on any traces of iron that may be in the cloth. This souring should always be made with hydrochloric acid, as it obviates the danger of any sulphate of lime being fixed in the fibres, or of giving bad whites in dyeing, effectually removes any iron, and leaves the goods softer.

Tables of strengths and proportions of substances employed in bleaching are not of much value, since they must be modified according to circumstances, but as a kind of guide or example the following particulars may be quoted: For 14,000 yards of nine-eighths printing cloth, 66 reed, 250 pounds of quicklime were used; in the liming 110 pounds of hydrochloric acid for the first souring, and 140 pounds of soda ash at 48 per cent. alkali, and 80 pounds of prepared resin, or resin soap made with resin and caustic alkali, were used in the bowking. The last souring was sulphuric acid sour at 3° C. (37.4° F.); the quantity of bleaching powder was not ascertained, but the solution stood at 1° = 1.006 sp. gr. Chloride of lime is generally termed chemic in the dye-house, and the solutions are made up to $\frac{1}{2}$ ° Twaddle, or 1.0025; but in some establishments this is increased to 5°. There is the danger of rotting the cloth when very strong chemic is employed, the process generally consisting in passing the articles rapidly through with the calender in order to saturate them, and then to pass them through the acid bath, the final operation being the washing; the calender renders the passage through the chemic very rapid, so that strong solution, even for fine goods, can be employed. The chemic must be clear, for any pieces or lumps of the chloride of lime coming in contact with the cloth would rot or burn it as the term runs, leaving holes. The chloride of lime of commerce is a mixture of calcium and hypochlorite of lime. In the process of oxidizing the foreign matters, which it is the purpose of bleaching to remove, to chloride is inefficacious, but the hypochlorite, under the influence of the water, or that of the carbonic acid of the air, sets free oxygen in its turn rendering the coloring matter soluble; the oxygen is separated. according to the following equation—



That is, one atom of hypochlorite of lime sets free two atoms of

oxygen, while one of free chlorine sets free only one atom of oxygen, according to the equation—



We thus see that the mixture known by the name chloride of lime contains only one-half of its chlorine in effective condition. After the cloth has been passed through the liquors employed in the process of bleaching, it becomes necessary to discharge the fluid, and this operation is effected by squeezing rollers, or squeezers. These are rollers generally worked under steam power, the upper one being caused to bear upon the cloth by its own weight, or by means of a weighted lever. There are many varieties of these machines, the description of which belongs, however, to mechanical engineering, and is not an essential of the chemical process of bleaching. When squeezed, which is sometimes effected over rollers heated by steam, the cloth if required for printing needs no further operation, but if intended for the market must be “finished,” that is, starched and calendered. Many bleachers prefer to prepare their own starch from flour, as they thus avoid the drying process for which the manufacturer of the starch must be paid.

The starch is colored with blue, generally ultramarine. It is disseminated over the cloth by means of rollers dipping into the starch, other rollers removing the excess. The starch need not be pure; fine clay or gypsum is sometimes employed as well. The pieces of cloth are occasionally artificially weighted with sulphate of baryta during the finishing, or with silicate of soda, the object of such an addition being to render the cloth solid in appearance. The calendering machine is really an ironing machine, surface and gloss being imparted to the cloth by means of heated rollers. The pieces when calendered and finished are subjected to hydraulic pressure.

Note.—Hydrochloric acid here mentioned is the ordinary muriatic acid.

No. 13.—*The Continuous Process of Bleaching.*

By all dyers and bleachers having extensive business the continuous process, sometimes known as the “new,” the “Bently,”

or "Pendleton" process, is generally adopted, effecting a considerable economy in time and labor. The process was first patented by David Bently, of Pendleton, in 1828, and in principle consists in drawing the goods successively through all the bleaching solutions, the pieces having been made continuous with the aid of the sewing machine.

The following is a general outline of the operations: The pieces having been sewn together with the aid of a machine are arranged in a carefully constructed rope coil, being generally drawn through an aperture of smooth glass or earthenware to impart this form. When the pieces have been singed they are drawn into and boiled in the first kier, containing 1 pound of caustic lime to 14 pounds of cloth. The kier is constructed to hold about 500 gallons, and the boiling is continued for thirteen hours. The pieces are next washed in the washing machine, and are then passed through a sour of hydrochloric acid at 2° Twaddle. Supposing 3500 pounds of cloth to be used, they are next bowked in a soda ash and resin solution containing 170 pounds of soda ash, 30 pounds of resin, 500 gallons of water. This boiling is continued for sixteen hours, and the goods are again washed. The cloth is next saturated with chemic or a solution of chloride of lime for two hours, the density of the solution being about $\frac{1}{2}^{\circ}$ Twaddle, when it is again washed. The continuous length is now boiled in a kier for five hours with 100 pounds of crystals of carbonate of soda, and after washing it is chemiced as before, then soured in hydrochloric acid of $2\frac{1}{2}^{\circ}$ Twaddle. The cloth is next allowed to drain; is washed until quite clean, squeezed between rollers, finally being dried over steam cylinders or by means of a hydro-extractor. To effect these operations in one continuous process many improvements have been suggested upon the plan pursued originally by Bently, of which the most important recently are those patented by Mr. Barlow in 1866. This inventor combines in one machine not only the various apparatus required for bleaching, but the operations successively of dyeing, printing, and sizing, subdividing the troughs or cisterns containing the mordants and the dyes by cross partitions, so that the several threads passing through the machine at the same time may be dyed in different colors, or partly left uncolored.

These machines are, however, not adapted to the bleaching of

linen. Linen does not possess the elasticity of cotton, and the strain would either pull the cloth narrow or tear it.

No. 14.—*Bleaching Raw Cotton in Small Quantities.*

The bleaching of raw cotton on a small scale is easily effected by the following method:—

Boil the cotton in fresh water, without any lye or soda, only a few minutes, merely to saturate it; long boiling would injure the fibre for spinning. Then pass the cotton into the bleaching vat containing chloride of lime in such quantity as the operator may consider necessary. The cotton should be handled for fifteen minutes, then allowed to remain for four or five hours, being placed upon an inclined board to allow the liquor to drain back. The cotton is now rinsed in small quantities. To every rinsing add 1 pound of diluted sulphuric acid; stir the cotton in this sour for a few minutes, then let it off, and give the cotton a few more waters so as to rinse all the acid away, then dry. The cotton will be quite white and easy to spin. The expense, inclusive of drying, will amount to about four cents per pound.

No. 15.—*The Bleaching of Flax Thread, etc.*

(By Mr. F. W. Hodges's Process.)

It is well known that the use of chloride of calcium in combination with an acid, suffices to completely bleach cotton, but this is not the case with flax. It was necessary for the purpose of perfecting the bleaching process to spread out the latter on a meadow, except in cases in which the yarn was to retain a cream color. Too strong a solution of chloride of soda, besides, deteriorated the flax. The latter became hard to the touch, and rough, and imparted to it so firmly its brown coloring matter that it was subsequently almost impossible to bleach it thoroughly. Mr. F. W. Hodges has succeeded in obviating all these drawbacks by introducing a new process by means of which even the threads receive a peculiar finish and finer look. The main points of the invention may be summed up as follows:—

- 1st. A new bleaching agent is made use of.
- 2d. The fibre is prepared for the bleaching.
- 3d. New machinery, shortening the operation.

4th. The doing away with exposure on meadows.

Instead of chloride of lime, Mr. Hodges uses hypochlorite of magnesia. Hitherto this substance had been applied, but a suitable manner of doing so had not been found, for the process in vogue was too expensive. Mr. Hodges, in the first place, discovered a novel method of preparing it, by far the most practical and least expensive one, for he uses as a raw material natural sulphate of magnesia, also called kieserite, met with in great quantities at Stassfurth among the excavated salts ("abraum salze"). To a solution thereof he adds a solution of common chloride of calcium. A double decomposition then takes place, hypochlorite of magnesia remaining in solution, while sulphate of lime is precipitated at the bottom of the tub. This sulphate of lime is gathered and calcined; it is so fine that its commercial value is much greater than that of plaster of Paris obtained in the ordinary manner. As for the clear solution, it constitutes the discoloring liquid employed by Mr. Hodges, and we may mention how for some time past the new process worked at the factory of Mr. W. Sibbald Johnston at Hietongs, near Belfast, Ireland. The principle upon which the process rests is to set free the chlorine and the oxygen of hypochlorite, not by the action of an acid, but by that of carbonate of soda. Carbonate of magnesia is then precipitated, and the active principles are set free. In practice there are used ten vats and twelve coops furnished with a swivel; each coop is filled with water or an active solution, as well as furnished with steam pipes. There may be worked in it at a time 250 kilos. (550 lbs.) of yarn. On top of these coops there are contrived rails supported by posts and a movable crane for the purpose of transporting the swivels from one coop to another. In connection with this crane there is a hydraulic pump capable of transferring a swivel full from one coop to another in a few seconds. After the skins are boiled, washed, and wrung in the usual manner, they are placed on a wagon which carries them to the first coop; there girls place them on the swivels, made to move by the aid of steam, first in one direction and then in another, in a solution of carbonate of soda heated by the steam pipes alluded to. As soon as the threads are well impregnated with carbonate the swivel is lifted by means of the hydraulic pump, and the crane then raises it on top of the next coop contain-

ing the discoloring liquid; it is there made to lower by means of the hydraulic pump, and the material is worked till the desired color is obtained. In the same manner the skeins are transferred to a fresh coop filled with water, where they are washed or they are left to stay there during a night. The operation is then finished, and the threads, as has been stated, possess a remarkable finish.

The process may also be used for bleaching cotton and other fibre. It is decidedly to be preferred for fine tissues such as lawn, owing to the absence of caustic lime, and it is even asserted that tissues thus bleached are more susceptible of receiving coloring matter when dyed. The magnesia salt is moreover cheaper and more rapidly effective for enlivening purposes when used in the place of hypochlorite of lime or hypochlorite of magnesia in printing.

No. 16.—*Patent Dry Process of Bleaching Cotton Goods.*

The patent refers especially to the treatment of cotton fillings. A wooden vat, lined with lead or enamelled sheet-iron, 9 feet long, 6 feet high, and $4\frac{1}{2}$ feet wide, capable of containing about 300 pounds of the goods is used. This vat communicates by a rubber tubing with an apparatus consisting of two parts, made of either earthenware or glass. The apparatus contains a mixture of quicklime, chloride of lime, alcohol, acetic acid, and 4 parts of water; the whole is treated with sulphuric acid, which develops about 2 cubic metres (2.61 cubic yards) of gas and steam. These fluids are under a pressure of two atmospheres, and, after two hours, the bleaching is finished. In order to remove every trace of odor, it is sufficient to put in the vessel a mixture of hydrogen, mixed beforehand in a wooden vessel, with carbonic acid and sulphuric ether gas. After fifteen minutes of this treatment, the goods are ready for market.

No. 17.—*Bleaching Linen.*

Make up a boiling solution of 25 pounds quicklime, and 12 pounds soda ash; let it cool; enter the yarn, and let it steep without heat for twelve hours; lift, rinse, and pass through weak sours (sulphuric acid), rinse again; stir up 8 pounds good chloride

of lime in water, let settle, and enter the yarn. Let it steep until perfectly white; lift, rinse, and pass through weak muriatic acid sours. Dissolve two pounds curd soap in boiling water, add as much ultramarine as may be required to give a blue tint; stir well together, enter the bleached yarn, lift, and dry.

No. 18.—*New Method for Bleaching Linen.*

Hypochlorite of lime is substituted by the hypochlorite of magnesia, which is economically made as follows:—

Take sulphate of magnesia and add a solution of the same to a solution of ordinary bleaching lime. There are then formed by double decomposition hypochlorite of magnesia, which remains in solution, and sulphate of lime, which in very fine division is precipitated. The clear liquid hypochlorite of magnesia constitutes the bleaching liquid.

Its chlorine and oxygen are liberated, not by the action of an acid, but by that of carbonate of soda. The hypochlorite of soda is very useful as a clearing agent in printing.

No. 19.—*Method of Preparing Bleaching Liquor.*

In decomposing chloride of lime for bleaching on the large scale it is advantageous to use bicarbonate of soda instead of sal soda, as by it there is formed a fine crystalline precipitate of carbonate of lime, from which the supernatant liquid is easily decanted off; whilst when soda crystals are used, an emulsion is formed which deposits but slowly.

A slight excess of the bicarbonate is not in the slightest degree injurious.

Bleaching liquor thus prepared bleaches perfectly and rapidly all kinds of linen and cotton fabrics.

No. 20.—*Peroxide of Hydrogen in Bleaching.*

Most bleaching agents produce more or less a rough surface. This is corrected by using peroxide of hydrogen, as it can be used in very slightly alkaline or acid baths. It is particularly good for sponge, hair, feathers, silk, ivory, bones, etc.

See that the articles are well cleaned and washed.

The bleach-bath is prepared with the peroxide of hydrogen in

proportion to the article to be bleached; some things are better with a slight trace of alkali added, and the goods lie in this until white. To hasten it heat may be applied, not to exceed 76° F. From two to fourteen days are required if done cold. Articles are not made brittle by this process.

No. 21.—*Bleaching Velvets, etc., that are to be Dyed Light Colors.* (For 200 lbs.)

Use a vessel at the boil which contains about 200 gallons of water and 30 pounds of soda ash. It must boil from three to four hours, and afterwards it must be taken out and cuddled up in a cistern of clean water; from here run the cloth through chemie (bleaching liquor) standing about 2° T.; then take it through a water-bath acidulated muriatic acid standing about $1\frac{1}{2}^{\circ}$ T. The cloth must then be washed, and is then for most purposes ready for the dye-house, but should it be required for dyeing light fancy shades it is necessary that the cloth should go twice through the same bleaching process before it is ready for dyeing.

No. 22.—*Bleaching Union Damask after Dyeing.*

To 60 yards take 1 pound chloride of lime finely strained through a sieve into lukewarm water. Handle the work well for fifteen minutes or so, and then lift and add $\frac{1}{4}$ pound of oil of vitriol, stir well, and handle for ten minutes, lift, and wash. The acid keeps it from running.

No. 23.—*To Bleach the White in Chrome Black.*

In bleaching the whites of goods colored chrome black, should such a process be required, to each piece of fabric dissolve 1 pound of hyposulphate of soda in two pails of water, to which add 1 pound sulphuric acid, the vessel containing the mixture being well covered so as not to lose any sulphurous acid gas. All the sulphur must be allowed to settle until the liquid is clear, and the liquid may then be run into a clean tub filled with water. In this bath the goods are to be laid for six to eight hours, when the whites will be found perfectly bleached without injury to the black. Rinse and dry.

No. 24.—*To Bleach for Printing.*

In the case of a large quantity of goods for printing it is more convenient to bleach them in large vats filled with water charged with sulphurous acid as follows:—

Half fill a stone with pine sawdust, cover it with a wooden cover, through which is a hole to receive a lead or glass pipe. Pour on enough sulphuric acid to cover the sawdust, and insert the pipe which conducts the sulphurous acid gas into the vat of water, rendering the joints gas-tight by a luting of clay to prevent too much free acid going over. The gas may be passed through a strong solution of soda and then to the vat. The vat of course should be covered; the goods are thrown into the water overnight, and when taken out will be found sufficiently bleached.

No. 25.—*Bleaching Turkey Red Cotton Stockings.*

Boil 100 dozen with 5 pounds of soda and 4 pounds of soap for several hours, then take them out and rinse. They should now be entered in the bleaching vat, which ought to be moderately strong. Handle the goods well, and let them lie in the liquor for a few hours, or until they are bleached enough; then take them out, allowing them to remain in the air as short a time as possible. They should then be soured for half an hour, rinsed, and scoured with soap. Inferior Turkey red dyed goods need great care in bleaching.

No. 26.—*Belgian Bleach for Linen or Cotton.* (100 lbs.)

Slake 22 pounds quicklime and dissolve 22 pounds carbonate of soda; pour off the clear, and boil the goods in this for one hour; wash, then take through a water in which spirit of salts has been added to show 2° B.; then bleach in a solution of 11 pounds chloride of lime for six hours; take again through spirit of salts at 2° B.; rinse well, and blue with 5½ pounds soap and ultramarine blue.

No. 27.—*Bleaching Ivory for Fans, etc.*

Place 2 quarts of peroxide of hydrogen in a stone pot, adding 4 ounces liq. ammon. fort. 880°; immerse the ivory and place

over a common shop stove for 24 to 30 hours; then take it out and gradually dry it in the air, not too quickly, or it will split. The deep color of the ivory is removed, and a beautiful pearly white ivory results when polished. The ivory is previously treated with a solution of common soda to get rid of greasy matter and open the pores.

No. 28.—*To Render Ivory Flexible.*

Ivory is rendered readily quite flexible by immersion in a solution of pure phosphoric acid (specific gravity 1.13) until it loses, or partially loses its opacity, when it is washed in clean cold water and dried. In this state it is as flexible as rubber, but gradually hardens by exposure to dry air. Immersion in hot water, however, restores its softness and pliancy. The following method may also be employed: Put the ivory to soak in 3 ounces nitric acid with 15 ounces of water. In three or four days the ivory will be soft.

No. 29.—*Bleaching Gutta Percha.*

Dissolve the gutta percha in twenty times its weight of boiling benzole; add to the solution plaster of very good quality, and agitate the mixture from time to time. By reposing for two days the plaster is deposited and carries down with it all the impurities of the gutta percha insoluble in benzole. The clear liquid decanted is introduced by small portions at a time into twice its volume of alcohol ninety per cent., agitating continually. During this operation the gutta percha is precipitated in the state of a pasty mass, perfectly white. The desiccation of the gutta percha, thus purified, requires several weeks' exposure to the air, but may be accelerated by trituration in a mortar, which liberates moisture that it tends to retain.

THE ACTION OF BLEACHING POWDER ON VEGETABLE
FIBRES.

Professor G. Lunge, of Zürich, who used to be manager of a chemical works on the Tyne, communicates the results of some experiments undertaken for him by Mr. F. Hodges, in order to ascertain if there is any foundation in the general belief that the insoluble part of the chloride of lime (bleaching powder) has a destroying

effect upon the vegetable fibres. Persoz, who is the originator of this belief, thinks that this destroying action is due to a basic chlorate, but this view he could not prove by experiments. It was necessary to ascertain first, whether chloride of lime could be completely extracted of all its bleaching compounds by washing with cold water, and if the insoluble residue really asserts a destroying effect on vegetable fibres. For these experiments were used: 1st, an English bleaching powder of 35.4 per cent.; 2d, a Swiss product of 37.67 per cent., and a chloride of lime, prepared in the laboratory, of 43.18 per cent. chlorine. By treating 10 gr. (0.35 oz.) of these three products for six consecutive times with 100 cc. (0.21 pint) water each time, the chlorine could be extracted until only 0.24 to 0.44 per cent. remained in the residue; but in order to exhaust it completely, 3 to 5 litres (6.3 to 10.5 pints) of water were found necessary. The residue, which amounted to from 7.9 to 8.1 per cent. of the original bleaching powder, proved perfectly indifferent against either cotton or linen fabrics, even when these latter were afterwards treated with weak acid, or when they were boiled for some time in the well exhausted chloride of lime residues; these reacted exactly in the same way as carbonate of lime, with which comparative experiments were made. Even calico printed with loose colors, by long treatment in the cold, or when heated, resisted any action, the strength of the fabric moreover not being at all injured. But if the bleaching powder was treated in the same way and with the same amount of water as used by the Irish bleachers, then 0.2 to 0.7 per cent. of chlorine was found in the residue, and some unbleached linen, after treatment with it and passage through an acid bath, showed unmistakable signs of the bleaching action. Therefore, it is concluded that the bleaching action of this residue, as observed by Persoz and others, is not due to the insoluble substance itself, but is caused by the chlorine, which has not been completely exhausted with water.

SECTION III.

WOOL DYEING.

RAW WOOL DYEING RECEIPTS.

(Each receipt, when not otherwise expressed, calls for 100 pounds of raw wool)

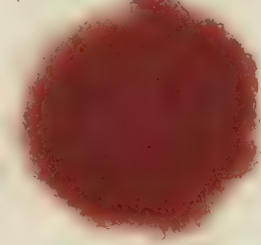
No. 1.—*Orange.*

Boil two hours with 4 pounds of cochineal, 25 pounds of young fustic, 3 pounds tartar, 3 quarts of nitrate tin.



No. 2.—*Fast Red or Scarlet.*

Enter a bath of boiling water with $4\frac{1}{2}$ pounds tartar, 25 pounds of fustic; 4 quarts of nitrate tin, 7 pounds of lac dye; keep in motion for $2\frac{1}{2}$ hours, and then take out.



No. 3.—*Royal Blue.*

Add to a bath of water 12 pounds of prussiate, 8 quarts of blue spirits, 5 quarts of finishing spirits; enter the wool cold, and raise to a boil, and set it in the bath for $1\frac{1}{2}$ hours.

No. 4.—*Yellow.*

Make up a bath of water and add to it 10 pounds of alum, 25 pounds of young fustic, 5 pounds of tartar, 5 quarts of nitrate of tin; enter the wool and boil for $1\frac{1}{2}$ hours.

No. 5.—*Olive Drab.*

Make up bath and add to it 1 pound of chrome ; enter this bath and boil $1\frac{1}{2}$ hour ; take out and dye off in another bath, with $1\frac{1}{2}$ pounds of logwood, 22 pounds of fustic, and a small quantity of redwood.

No. 6.—*Brown Drab.*

Enter a bath with $2\frac{1}{2}$ pounds of fustic, six ounces of argol, 1 pound of logwood, 2 pounds of camwood ; boil 1 hour, and darken with $1\frac{1}{2}$ pounds of copperas, and wash off.

No. 7.—*Stone Drab.*

Boil one-half hour in 8 ounces of chrome, and dye in another bath with 4 ounces of logwood, $1\frac{1}{2}$ pounds of fustic ; 6 ounces of sumac, and a small quantity of ground peachwood.

No. 8.—*Dark Brown.*

Dye off with 30 pounds of camwood, 10 pounds of red argol, 2 quarts of oil of vitriol, 3 pints of sulphate of indigo, 5 pounds of turmeric ; boil 2 hours.

No. 9.—*Dove Color.*

Enter a bath one pound of paste cochineal, 2 pints of extract of indigo, 4 pounds of tartar ; enter the wool, and boil one hour.

No. 10.—*Bottle Green.*

Add to a boiling-hot bath 25 pounds of fustic, 25 pounds of alum, 10 pounds of red argol, 2 quarts sulphate of indigo ; enter wool, and boil $1\frac{1}{2}$ hours.

No. 11.—*Invisible Green.*

Add to a hot bath 5 pints of indigo, 12 pounds of argol, $5\frac{1}{2}$ pounds of logwood, 12 pounds alum ; enter wool, and boil 2 hours.

No. 12.—*Apple Green.*

Add to a boiling-hot bath of water 1 quart oil of vitriol, 6 pounds of red argol, 3 pints of extract of indigo, 12 pounds turmeric ; enter wool, and boil one hour.

No. 13.—*Ruby on Wool* (50 pounds).

Preparation: 3 pounds tartar, and 2 pounds alum; boil half an hour, and wash in three warm waters.

Dyeing: 8 pounds Lima-wood; $\frac{1}{2}$ pound cudbear and $\frac{3}{4}$ pound tartar; boil half an hour, and blue to pattern with hot water in a separate bath.

No. 14.—*Pansy on Wool* (100 pounds).

Prepare with 11 pounds alum, $5\frac{1}{2}$ pounds argols, 1 pound tin crystals, $\frac{1}{2}$ pound muriate of tin; boil two hours.

Dye with logwood, peachwood, or hypernic to shade. Use less for lighter shades.

No. 15.—*Olive to stand fulling on Wool.*

Sanders 2 per cent. boiled out with the fustic first. Fustic 50 per cent., bluestone 5 per cent., argol 2 per cent., copperas 1 per cent.; boil $1\frac{1}{2}$ hours.

No. 16.—*Dark Olive to stand fulling on Wool.*

50 per cent. fustic, 5 per cent. logwood, 4 per cent. bluestone, 4 per cent. argol, 3 per cent. archil, 1 per cent. copperas; boil $1\frac{1}{2}$ hours.

No. 17.—*Blood Color on Wool* (5 kilos.=11 lbs.).

Mordant with 50 grams. (1.75 oz.) chrome, 20 grams. (0.7 oz.) bluestone, 500 grams. (17.5 oz.) cream tartar, 25 grams. (0.87 oz.) oil vitriol.

Dye with a filtered decoction of 100 gr. (3.5 oz.) fuchsine and 120 to 150 gr. (4.2 to 5.25 oz.) logwood. If the cast is to be darkened, the mordant is strengthened a little by doubling the dose of bichromate, blue vitriol and sulphuric acid, and finally dye with 2 kilos. (4.4 lbs.) Lima-wood, 150 gr. (5.25 oz.) fuchsine, 50 gr. (1.75 oz.) aniline orange, and $\frac{1}{2}$ kilo. (1.1 lb.) logwood.

No. 18.—*Claret on Wool* (50 lbs.).

Preparation: $1\frac{1}{2}$ pounds chrome.

Dyeing: 9 pounds Lima-wood, 2 pounds logwood, $\frac{1}{2}$ pound tartar; boil half an hour.

No. 19.—*Garnet on Wool* (5 kilos.=11 lbs.).

Mordant with 50 gr. (1.75 oz.) chrome, 20 gr. (0.7 oz.) bluestone, 500 gr. (17.5 oz.) cream tartar, 25 gr. (0.87 oz.) oil of vitriol; boil half an hour.

Dye with 250 gr. (8.75 oz.) fustic, $1\frac{1}{2}$ kilos. (3.3 lbs.) Lima-wood, 150 gr. (5.25 oz.) logwood.

No. 20.—*Dark Brown* (100 lbs.).

Prepared tartar	.	.	.	.	8 $\frac{3}{4}$ lbs.
Sulphate of soda	.	.	.	.	4 " 6 ozs.
Ponceau	.	.	.	.	6 "
Bordeaux	.	.	.	.	1 $\frac{3}{4}$ "
Magenta	.	.	.	.	$\frac{7}{8}$ "
Fast yellow	.	.	.	.	3 lbs. 2 "
Indigotine dark	.	.	.	.	3 $\frac{3}{4}$ "

The aniline colors and the indigotine are well dissolved before being added to the water. Enter the yarn at 100° F., raise to 212° F.; boil for one hour, and rinse.

No. 21.—*Cardinal* (50 lbs.).

Prepared tartar	.	.	.	.	4 lbs.
Sulphate of soda	.	.	.	.	2 "
Scarlet 2 R.	.	.	.	.	3 $\frac{1}{4}$ ozs.
Acid magenta	.	.	.	.	4 "

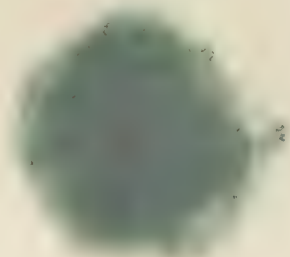
Dissolve the colors well; enter at 100° F., and turn well whilst raising to a boil; boil for half an hour; lift, and raise.

No. 22.—*Fast Canary* (100 lbs.).

Dissolve 4 ounces naphthaline yellow, to which add 3 pounds sulphuric acid and 10 pounds glauber salts. Commence at 100°, and well pole to the boil. If commenced too hot it is liable to take unevenly.

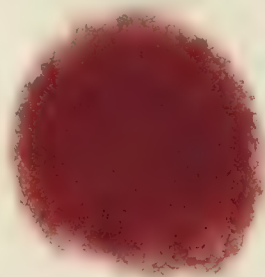
No. 23.—*Malachite Green* (100 lbs.).

Dissolve 1 pound of green, and proceed as for canary.

No. 24.—*Fast B. Red.*

Dissolve equal parts of 1 B. scarlet and acid magenta, and proceed as for canary.

For yellower shade add orange. For darker shades add acid claret, or archil, or even acid violet.

No. 25.—*Aniline Scarlets to fix for Fulling.*

Dye in the usual way, but add $1\frac{1}{2}$ pounds of muriatic acid and 3 pounds of sulphate of soda to 100 pounds of goods; boil in with the color.

No. 26.—*Eosine on Wool* (100 lbs.).

From 2 to $2\frac{1}{2}$ pounds of alum (not alumina) are dissolved, and from 3 to 4 pounds eosine according to depth of shade required, dissolved and added to a cold bath, when the heat is slowly raised to a boil. The richness of this color is very intense.



No. 27.—*Rose Color on Wool* (40 lbs.).

1 pound cochineal,
3 gills double muriate of tin,
1 pound tartaric acid.

Enter at 100° F.; heat up; boil fifteen minutes; lift, and cool to 120° F. by throwing out part of the liquor and filling up with water; add 1 gill of ammonia paste, 12 ounces tartaric acid, 6 ounces oxalic acid; bring up to the boil; when the desired shade is obtained wash and dry well.

No. 28.—*Acid Magenta Rose.*

Pink and rose shades may also be obtained with roseine, acid magenta, eosine, saffronine, and phloxine. See silk dyeing on pink.

No. 29.—*Scarlet with Cochineal on Wool.*

For 50 lbs.:—

For 1 lb.:—

Boil	4 lbs. cochineal,	1 $\frac{1}{4}$ oz.
	1 $\frac{3}{4}$ " bark,	$\frac{1}{2}$ "
	3 " tartar,	nearly 1 "
	and add 2 quarts scarlet spirits.	2 "

Enter at 200° F.; boil one hour; wash well.

Note.—Sour before dyeing either cold or warm; one water out.

No. 30.—*Scarlet with Lac on Wool.*

For 50 lbs.:—

For 1 lb.:—

Boil	5 $\frac{1}{2}$ lbs. lac,	1 $\frac{3}{4}$ oz.
	1 $\frac{1}{2}$ " bark,	$\frac{1}{2}$ "
	3 " tartar,	1 "
	and add 2 quarts lac scarlet spirits	2 "

Enter at 200° F.; boil one hour; wash well. Sour like scarlet with cochineal.

No. 31.—*Scarlet with Lac and Cochineal on Wool.*

For 50 lbs.:—

Boil $4\frac{1}{2}$ lbs. lac,1 $\frac{3}{4}$ “ bark,

2 “ tartar,

and add 2 quarts lac scarlet spirits.

For 1 lb.:—

1 $\frac{1}{2}$ oz. $\frac{1}{2}$ “fully $\frac{1}{2}$ “

2 “

Enter at 200° F.; boil in this thirty minutes; lift, and wash well.

Then in a boiler of clean water

Boil 14 oz. cochineal,

 $\frac{1}{4}$ oz.

14 “ tartar,

 $\frac{1}{4}$ “and add 1 $\frac{1}{2}$ pints scarlet spirits.1 $\frac{3}{4}$ “

Enter at 200° F.; boil twenty minutes, and wash out well; sour.

No. 32.—*New Scarlet on Wool.*

Yarn well scoured (60 lbs.), washed in warm water, and whizzed; run cistern three-quarters full and boil; put in 10 ounces scarlet O O (A. Poirrier & Co.), boil well, and add 9 lbs. sulphate of soda (Glauber salts), and 1 quart vitriol (sulphuric acid); run up with cold water, and give a good stir up, and enter yarn; keep turning for fifteen or twenty minutes; heat gradually to a boil in about one hour and a quarter, and on no account enter hotter, as the dye has an affinity for the wool, it being all taken up before the boil commences. The scarlet O O mentioned above is made by A. Poirrier & Co., of Paris, and is really one of their “Ponceaus.”

No. 33.—*Aniline Scarlet.*

Sometimes called Fast Red, and by the absurd name of Patent Crimson, and Ponceau. All belong to the same family of azo colors, and are quite as fast as lac or cochineal colors, and at the same time are quite as bright, and much cheaper.

As a difference of opinion exists as to the advantages of mordanting or not, I may say that from my experience I do not see but that I get as good results with simply sulphuric acid, and for evenness Glauber salts in the color at the start, as by mordanting first.

I purpose, however, giving the various plans of using, and leaving the reader to form his own opinion of their merits.



To 100 pounds woollen goods, dissolve 2 pounds of aniline scarlet; then run the bath up to 150° F., and add 2 pounds sulphuric acid and 10 pounds Glauber salts; enter goods, and bring the boil slowly up. If the ingredients are added twice before raising the heat, much more certain or even results are likely to be secured.

The above is given for a full shade, $1\frac{1}{2}$ pounds will give a fair shade.

No. 34.—*Fast Crimson on Wool.*

For 200 yards:—

For 10 yards:—

Bottoming preparation	{	2 lbs. cudbear,	$1\frac{1}{2}$ oz. fully,
		$1\frac{1}{2}$ " tartar,	$1\frac{1}{4}$ "
		$1\frac{1}{2}$ qt. scarlet spirits,	$3\frac{1}{2}$ "
Dyeing,		$2\frac{1}{2}$ lbs. cochineal.	2 "

Boil or scald the cudbear; winch in this thirty minutes, then prepare and dye like scarlet with cochineal (No. 29).

No. 35.—*Ponceau on Wool.*

For 50 lbs.:—

For 1 lb.:—

4 lbs. cochineal,	$1\frac{1}{4}$ oz.
1 lb. bark,	fully 5 drachms,
2 lbs. tartar,	nearly 1 oz.
2 qts. scarlet spirits.	2 "

Enter at 206° F.; boil one hour; wash well; sour like scarlet with cochineal. A fine color, and permanent, may be got from aniline ponceau.

No. 36.—*Lima-wood Crimson on Wool (50 lbs.).*

Prepare with 2 pounds alum and $\frac{1}{2}$ pound tartar; boil half an hour; wash in three warm waters. Boil 11 pounds Lima-wood and add $\frac{1}{2}$ pound cudbear; boil in this for half an hour, and blue

with warm water. Hypernic may be used in place of Lima-wood or Brazil-wood.

No. 37.—*Cochineal Crimson on Wool* (50 lbs.).

3½ pounds cochineal, or 3 pounds crimson powder (cochineal paste dried), 2½ pounds tartar, 2 quarts crimson spirits; boil half an hour; wash well; blue with soda. If crimson powder is used no soda is required. Crimson powder is ammoniated ground cochineal bleached till dry.

No. 38.—*Aniline Scarlet* (100 lbs.).

Dissolve 2 pounds color and 2 pounds alum; enter at 150° F., and bring slowly to the boil.

No. 39.—*Another Way* (for 100 lbs.).

Proceed as above, only use muriatic acid in place of alum.

No. 40.—*Another Way* (for 100 lbs.).

Prepare with 1 pound alum, 1 pound tartar, 1 pint muriate of tin; lift, then add the color.

No. 41.—*Another Way* (for 100 lbs.).

Prepare with 1 pound tartar, ½ pound oxalic acid, 1 pint muriate of tin or oxymuriate of antimony; then lift, and add the color.

Without going further it will be seen that almost any simple acid will act as a mordant for this scarlet.

It is well known that cochineal scarlets worn near the body oxidize to a purple-black shade by the chemical action of the iron of the body saddening the cochineal. This I feel certain will not be the case with azo scarlets. The cause of cochineal scarlets oxidizing is, the iron in the perspiration of the body produces a reaction of the cochineal to its normal color by neutralizing the tin salts used in dyeing.

No. 42.—*Acid Cardinal*.

Equal parts B B B scarlet and acid magenta.



No. 43.—*Acid Cardinal.*

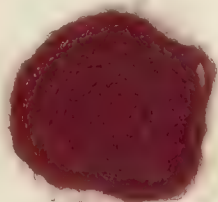
Equal parts orange and acid magenta.

The above are sometimes called Imperial Red, Fast Red, and Cardinals. All quite fast colors.

Every shade of the above can be obtained in the following manner:—

For the light shades dissolve separately acid magenta and acid orange or scarlet.

For dark shades add acid claret or darken with archil; use the same mordant as for scarlet aniline.

No. 44.—*Garnet Fast.*

All shades can be got with orange and acid magenta, worked with an acid.

No. 45.—*Maroon Fast.*

To 100 pounds prepare with 6 pounds alum, 2 pounds tartar, 1 pint sulphuric acid.

Dye with cudbear, archil, or hypernic. For red shade add fustic; for darker, logwood.

No. 46.—*Maroon with Aniline, Fast.*

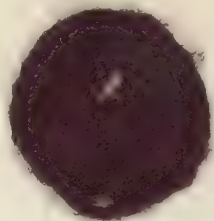
Proceed as for garnet, only use less orange.

No. 47.—*Ruby Fast.*

Prepare as for maroon, and dye with archil or cudbear; for blue shade add a little ammonia at the finish.

No. 48.—*Claret Fast.*

Prepare as for maroon, and dye with archil and logwood to shade.

No. 49.—*Chocolate or Mulberry Fast.*

Prepare as for maroon and as for claret, only double the amount of logwood.

No. 50.—*Aniline Claret Fast.*

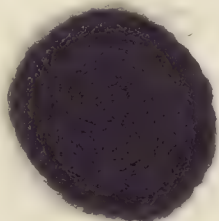
Dye with acid claret 1 per cent., sulphuric acid 2 per cent., Glauber salts 10 per cent.

No. 51.—*Plum (100 lbs.).*

Prepare with 5 pounds alum, 5 pounds argols, 2 pounds chrome. Dye with logwood and archil to shade.

2d. For cheap colors archil may be left out, and raised, if too dark, with muriate of tin.

3d. Prepare with $2\frac{1}{2}$ pounds chrome. Dye with the logwood and violet.

No. 52.—*Aniline Primrose (100 lbs.).*

Dissolve 4 ounces acid primrose, run up to 150° F.; add 1 pound oil of vitriol, and very gradually raise to the boil.

All the acid aniline colors are better dissolved first, and added at two or three times for the sake of evenness.



No. 53.—*Aniline Straw Color* (100 lbs.).

Dissolve 4 ounces acid yellow, and proceed as above.

No. 54.—*Aniline Buff* (100 lbs.).

Dissolve 2 ounces aniline yellow, 2 ounces acid Bismark brown, and proceed as with No. 52.

No. 55.—*Aniline Yellow* (100 lbs.).

Dissolve 4 ounces aniline yellow, and proceed as with No. 52.

No. 56.—*Aniline Amber equal to Flavine*.

Dissolve 1 pound for 100 pounds of goods, and proceed as with No. 52.

No. 57.—*Aniline Orange* (100 lbs.).

Take 1 pound of yellow or red shade of acid orange according to the shade required, and proceed as with No. 52.

No. 58.—*Aniline Salmon* (100 lbs.).

Take 6 ounces of red shade orange, and proceed as with No. 52. If not red enough, add a little scarlet or archil. From 5 to 10 pounds Glauber salt may be used with the above 7 colors to even them.

No. 59.—*Aniline Flesh Color*.

Use one quarter the amount of ingredients as for salmon.

No. 60.—*Aniline Old Gold Color.*

Acid amber, acid brown, and acid green, dissolve separately and add them to the shade required; work with sulphuric and Glauber's salts.

No. 61.—*Buff on Woollens.*

For 45 lbs.:—

Boil $4\frac{1}{2}$ lbs. fustic,

$1\frac{1}{2}$ “ madder,

Add 7 pounds alum.

Enter at 200° F. Boil thirty minutes.

No. 62.—*Primrose on Woollens.*

For 30 lbs.:—

Boil $2\frac{1}{2}$ lbs. bark,

Add 2 “ tartar,

2 quarts muriate of tin.

Enter at 150° F.; boil thirty minutes. A cheap color is gotten with turmeric and acid, but it is very fugitive.

No. 63.—*Yellow on Woollens.*

For 40 lbs.:—

$2\frac{1}{2}$ lbs. bark,

2 “ tartar,

2 quarts muriate of tin.

Enter at 150° F.; boil thirty minutes.

No. 64.—*Straw on Woollens.*

For 50 lbs.:—

Boil $3\frac{1}{4}$ lbs. bark, and

3 oz. cochineal,

Add $2\frac{1}{2}$ “ tartar,

3 quarts muriate of tin.

Enter at 150° F.; boil thirty minutes.

No. 65.—*Amber on Woollens.*

For 40 lbs.:—

Boil 4 lbs. bark, and
8 oz. madder,
Add 2 quarts muriate of tin,
1 lb. tartar.

Enter at 200° F.; boil thirty minutes.

No. 66.—*Orange on Woollens.*

For 50 lbs.:—

Boil 10 lbs. bark, and
1½ “ cochineal.
Add 2½ “ tartar, and
2½ quarts yellow spirits.

Enter 200° F.; boil thirty minutes.

No. 67.—*Orange with Madder on Woollens.*

To 50 pounds yarn add to the yellow kettle above:—

1 lb. flavine,
5 “ alum,
2 “ muriate of tin,
2 oz. of tin crystals,
5 lbs. madder.

This kettle must be boiled for ten minutes, and then cooled to 170° F. The yarn is now to be entered, turning it quickly a few times to obtain evenness, then slowly for about fifteen minutes. It can then be removed, rinsed, and dried.

No. 68.—*Quebracho Wood for Dyeing Wool.*

F. Rhem lately communicated a paper on the Quebracho Wood, in the *Société Industrielle de Rouen*, from which the following

particulars are extracted: this wood belongs to the family of the Asclepiades, and comes from America. Being very hard, and composed of a great quantity of interlaced fibres, the tannin it contains is different from that of chestnut or oak. Gelatine precipitates this tannin out of a water solution with a flesh color, while salts of protoxide of iron give an ash-gray precipitate and the peroxide salts a dirty greenish coloration. When boiled with weak sulphuric acid the tannin is not converted into gallic acid. According to a German chemist, Quebracho contains 18 per cent. of tannic acid. The bark of this wood contains an alkaloid analogous to quinine. Extract of Quebracho, now much used in wool dyeing, gives a yellow shade with a tin solution. It gives even shades resembling those of cutch, if used with bichromate of potash; but its principal use is for obtaining blacks, for which the wool is first given a bottom of the extract, then passed through iron and dyed with the Quebracho; this, in these conditions, can replace cutch. Solutions of Quebracho wood or extract will only keep limpid if heated to a certain temperature, but get turbid on cooling. Dyeing experiments with the dry Quebracho extract, as manufactured by a French firm, in comparison with cutch, have proved the former of more value, since, with a lower price, it possesses a greater richness of coloring matter. Three series of trials were made: One by passing the cotton prepared in a Quebracho or cutch bath through bichromate of potash; the second, through iron; and in a third, the patterns were passed through iron and then chromed. In all the cases the same results were obtained, showing the advantages of the Quebracho over cutch in spite of the slightly more grayish shade of the colors obtained with the former. The same results have been got by printing mordants on calico, ageing, dunging, and dyeing with Quebracho extract or cutch—in all cases the Quebracho shades being identical with those of cutch, not only for the tone of color, but also in regard to fastness.

No. 69.—*Golden Yellow Dye.*

A beautiful golden-yellow dye is now prepared from the young wood of various poplars. The young branches and shoots are cut off, crushed, and brayed, then boiled in alum water in the propor-

tions of ten pounds of wood and one pound of powdered alum to three gallons of water. The liquor is boiled from twenty minutes to half an hour, and then filtered. In cooling it thickens and clears, throwing down a greenish-yellow deposit of resinous matter. When sufficiently clear the liquid is again filtered and then left exposed to the air for three or more days, according to the weather and the atmosphere. It quickly oxidizes under the action of the light and air, and assumes a rich golden tint, and in this state can be used for dyeing fabrics of all descriptions. For yellow and orange-yellow shades it is used alone.

No. 70.—*To Mordant Wool for Methyl Green and to Dye Woollen Goods with Methyl Green.*

1st. Mordanting.

Water 875 gallons to 220 pounds wool.

Hyposulphite of soda 20 per cent. of the weight of the wool.

Alum 10 per cent. of the weight of the wool.

Sulphuric acid 6 per cent. of the weight of the wool.

The acid must not be added to the dye-beck till the hyposulphite and the alum are dissolved.

Enter the wool at about 140° F. For pieces raise by degrees to a boil, after having kept the heat for about half an hour between 158° and 176° F. For wool it is better not to exceed 185° F., keeping the temperature for thirty to forty-five minutes between 167° and 185° F. Towards the end of the process of mordanting, the beck, which was at first milky, becomes clear in consequence of the absorption of the mordants by the wool. After mordanting the wool is lifted, and washed very carefully in a strong flow of water.

2d. Dyeing.

Make up a water at 122° F., with methyl green and picric acid more or less in quantity according to the depth of shade and the more or less yellowish tone required. For 220 pounds of wool the quantities of color and of water for a medium shade are about the following:—

Water	.	.	.	.	.	875 to 1000 gals.
Methyl green	.	.	.	.	.	24 $\frac{1}{4}$ ozs.
Acetate of zinc	.	.	.	.	.	8 $\frac{3}{4}$ lbs.

This last product should be added to the beck in order to acidulate it slightly, since, if the liquid is not sufficiently acid, the picric acid does not work on; and besides, the shade is not perfectly even.

In the course of the operation there is developed an excess of acetate of zinc which hinders the green from taking on, and which must then be neutralized by means of acetate of soda added by degrees.

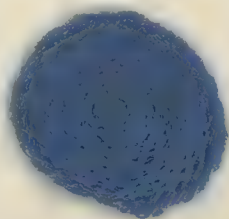
Thus, if we see that the picric acid does not take on we add a little acetate of zinc; if, on the contrary, the green is not developed, and the picric acid seems to take on more readily than the green, and to predominate as a shade, we add acetate of soda in a proportion which, however, should not exceed three times the acetate of zinc indicated above, otherwise the bath might become alkaline, which must be avoided, and which may be ascertained by means of litmus paper. (In testing a colored solution with litmus paper to ascertain its acidity or alkalinity, float the paper on the surface of the liquid.) The dye-beck will not be completely exhausted, but this is of little consequence, as it may be preserved indefinitely and constantly employed by adding fresh quantities of green. No trace of copper or lead must be present. The dye-beck should be of wood, with tin steam-pipes.

No. 71.—*Bluish Green* (50 kilos. = 110 lbs.).

First add 2 kilos. (4.4 lbs.) red prussiate, 2 kilos. (4.4 lbs.) of alum, 500 gr. (17.5 oz.) muriate of tin, 1 kilo. (2.2 lbs.) sulphuric acid; boil one hour; then add 1 kilo. (2.2 lbs.) of alum, $2\frac{1}{2}$ kilos. (5.5 lbs.) of fustic, and 750 gr. (26.25 oz.) of Madras blue; boil and wash.

No. 72.—*Peacock Green*.

Almost any shade may be obtained by using acid aniline green and Nicholson blue, working them with sulphuric acid and Glauber's salt. The purer the shade required the higher No. of blue will be required, say 4 or 5 B.; and for darker one B. will answer.



No. 73.—*Alkali Peacock Green.*

It is obtained in the same manner as alkali blue—that is, use the No. B. blue to suit your pattern, and aniline alkali green more or less according to the shade. The liquor is made alkaline with borax or soda, and worked just the same as Nicholson blue. Then wash in cold water, and develop in a warm bath made slightly acid with oil of vitriol.

This way is faster than the last, as all Nicholson blues, dyed in the presence of acid, smut.

No. 74.—*Pea Green (54 lbs.).*

2 pounds extract of indigo, 7 pounds fustic, 1 pound alum. When the boiler heats to 180° F. put in and boil fifteen minutes. The fustic must always be boiled before the other ingredients are added.

No. 75.—*Common Pale Green (50 lbs.).*

3½ pounds extract of indigo, 4 pounds ebony ground, 10 ounces tartar, 1 gill sulphuric acid. Same as pea green; give the extract and acid first; when at 180° F. put in the fustic and tartar; boil fifteen minutes. In this case the fustic should be boiled separately.

No. 76.—*Grass Green (50 lbs.).*

Boil 20 pounds fustic, 7 pounds extract of indigo, 1½ pounds tartar, 3 gills sulphuric acid. Done in the same manner as above (No. 75).

Young fustic is preferable for light greens, and ordinarily will do for dark shades.

No. 77.—*Picric Green for 60 yards Damask. (A Flannel.)*

After cleaning goods should be soured off. This obviates the necessity of adding acid to the dye baths, and as a consequence the picric will be better taken up. Indigo paste 8 ounces, picric 2 ounces. Some prefer to give it the blue first, but my experience is, if the blue is given twice it answers quite as well. It should be entered at hand heat, and well opened until it has exhausted all the blue; then lift, and add the other half, and boil in for

fifteen or thirty minutes ; lift, and wash in cold water made slightly acid. By regulating the blue and yellow any shade of green can be obtained. Silks can be dyed in the same way, only the heat must not be higher than 150° F., and they require drying quickly.

No. 78.—*Olive Green* (50 lbs.).

Prepare with $1\frac{1}{2}$ pounds chrome ; boil half an hour and wash in two waters, and then boil 12 pounds fustic, $2\frac{1}{2}$ pounds logwood for one hour ; enter, boil half an hour, rinse in the same liquor with 4 ounces of bluestone ; wash well and dry.

No. 79.—*Fast Green* (50 lbs.).

First give a medium blue in the vat, then make up a bath as follows :—

$5\frac{1}{2}$ pounds alum, $1\frac{3}{4}$ pounds argol, 1 pound bluestone, $8\frac{3}{4}$ pounds fustic, 1 pound indigo extract ; boil in from 1 to $1\frac{1}{2}$ hours.

For darker shades use logwood to pattern or logwood and barwood.

No. 80.—*Myrtle Green*.

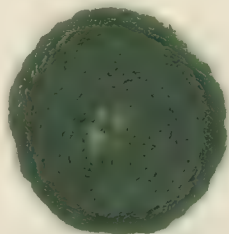
For 50 lbs :—

25 lbs. fustic,
 $1\frac{1}{4}$ lbs. camwood,
 5 lbs. extract of indigo,
 4 lbs. alum,
 2 gills sulphuric acid,

For 1 lb :—

$\frac{1}{2}$ lb.
 nearly $\frac{1}{2}$ oz.
 $1\frac{1}{2}$ oz.
 $1\frac{1}{4}$ oz.
 $\frac{1}{3}$ oz.

Boil the fustic and camwood well, then add the paste, alum, and acid ; boil all together a short time ; enter, and boil half an hour. If done at twice, give the extract and acid first. Then in a clean boiler give the fustic, camwood, and alum ; boil half an hour each time.



No. 81.—*Bottle Green.*

Dyed in the same way as No. 80, only use more extract of indigo. Second way, dye as described, and top with aniline green to shade.

No. 82.—*Olive.*

For 5 kilos. (11 lbs.). After thoroughly washing the goods to be dyed, a bath is prepared with a decoction of 1 kilo. (2.2 lbs.) redwood, 1 kilo. (2.2 lbs.) fustic, and 1 kilo. (2.2 lbs.) logwood, in which they are well worked, cold, when gradually the temperature is raised to the boiling point, and left to boil for half an hour. Then wash and dress.

No. 83.—*Alkali Aniline Green.*

This is a new product, and is to be treated in the same manner as alkali blue, that is, dye with equal weight of color and borax, then raise with sulphuric acid in a separate bath. Yellower shades are dyed by giving picric in the acid bath.

No. 84.—*Malachite Green.*

Take equal parts of color and borax about 1 pound to 100 of goods. The color is raised after dyeing with a weak sour. Fustic, turmeric, or picric can be used for yellower shades.

No. 85.—*Acid Aniline Green.*

This also is a new color, and can be used with sulphuric acid in the same bath as the color.

No. 86.—*Bronze.*

Take 8 parts acid Bismark, 4 parts acid green, 3 parts acid yellow. Add the same to the depth of shade required, working it with sulphuric acid.

For other bronze shades see Flannel Dyeing.



No. 87.—*Stone on Wool.*

For 50 lbs:—

1 lb. logwood,
 4 oz. fustic,
 8 oz. extract of indigo,
 3 lbs. alum,
 1½ lbs. tartar,

For 1 lb:—

5 drachms,
 1¼ “
 2½ “
 nearly 1 oz.
 ½ oz.

Enter at 15° F., and boil half an hour; wash off. All dark shades may be prepared with 1 lb. of chrome to 100 lbs. of goods; wash from the chrome.

No. 88.—*Lavender on Wool (45 lbs.).*

Boil 2 pounds of logwood and 2 pounds alum, add 10 pounds extract of indigo, enter cold, and bring up to the boil.

No. 89.—*French Gray on Wool (50 lbs.).*

Boil 7 pounds fustic, and 12 ounces cudbear, add 6 ounces extract of indigo, cool to 180° F., and add 1 pint of oil of vitriol; boil 20 minutes.

No. 90.—*Silver Gray on Wool (50 lbs.).*

Boil 1 lb. logwood and 2½ lbs. alum; add 5 ozs. extract of indigo, brought on from 100° F.; boil ten minutes.

No. 91.—*Dark Gray to stand Fulling, on Wool.*

Extract of sumac, 2 per cent.; extract of logwood, 1 per cent.; copperas, 2 per cent.; boil one hour and a half.

No. 92.—*Light Gray to stand Fulling, on Wool.*

Extract of sumac, 2 per cent.; extract of logwood, 1 per cent.; violet, ⅓ per cent.; copperas, 1 per cent.; boil one and a half hours.

No. 93.—*Slate on Wool (50 lbs.).*

1 lb. logwood,
 8 ozs. extract of indigo,
 4 ozs. fustic,
 2 lbs. tartar,
 2 lbs. alum.

Same as No. 87.

No. 94.—*Drab on Wool.*

For 50 lbs.:—

7 lbs. fustic,
 8 ozs. madder,
 4 ozs. cudbear,
 2 lbs. alum,
 8 ozs. tartar,

For 1 lb.:—

fully 2 ozs.
 $2\frac{1}{2}$ drachms.
 $1\frac{1}{4}$ “
 fully $\frac{1}{2}$ oz.
 $2\frac{1}{2}$ drachms.

Enter between the cold and 160° F.; after heating up, boil from ten to thirty minutes; wash in two waters. All dark shades of these colors may be slightly prepared with chrome. Wash in two waters, from which wash in two waters.

No. 95.—*Light Drab on Wool (56 lbs.).*

4 lbs. fustic,
 $1\frac{3}{4}$ lb. alum,
 4 ozs. madder,
 4 ozs. tartar,
 $3\frac{1}{2}$ ozs. cudbear.

Same as drab (No. 94).

No. 96.—*Fawn on Wool (50 lbs.).*

5 lbs. fustic,
 1 lb. madder,
 $\frac{1}{2}$ lb. camwood,
 $\frac{1}{2}$ lb. cudbear,
 2 lbs. alum.

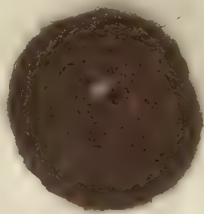
Same as drab (No. 94).

No. 97.—*Cinnamon on Wool.*

For 50 lbs., 8 lbs. fustic, 2 lbs. madder, 10 ozs. cudbear, 1 lb. tartar, 2 lbs. alum. Give two runs, and sadden with 3 or 4 ozs. of copperas.

No. 98.—*French Brown.*For 50 lbs. preparation, $1\frac{1}{2}$ lbs. chrome.Dyeing, 6 lbs. fustic, 1 lb. ground madder, $\frac{1}{2}$ lb. cudbear,

1 lb. tartar, and if not dark enough, add 8 ozs. logwood. Boil half an hour.



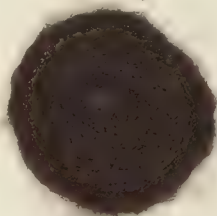
No. 99.—*Light Brown or Giraffe on Wool.*

40 lbs. yarn or 90 yards moreen. Boil 9 lbs. fustic, $1\frac{1}{2}$ lbs. madder, and 8 ozs cudbear; add 2 ozs. alum, 1 qt. muriate of tin. Enter at 200° F., and boil thirty minutes.

No. 100.—*Reddish Chestnut Brown* (25 kilos.=55 lbs.).

Boil for three-quarters of an hour with 875 grams (30.6 oz.) of chrome, 500 grams (17.5 ozs.) sulphuric acid; wash out and dye with hypernic (or Lima-wood), fustic, and logwood to shade.

For more fiery shades add a little alum at the finish with the woods.



No. 101.—*Deep Brown for Cloth* (50 lbs.).

Boil 1 hour with 8 ozs. chrome, 8 ozs. tartar, 8 ozs. alum, 4 ozs. oil vitriol; wash and dye with cudbear or orchil, fustic and logwood to shade; the deepest seal brown can be obtained this way by adding the logwood to shade.

No. 102.—*Bismark Brown* (100 lbs.).

First bath: prepare 1 pound of alum, 1 pound of tartar, boil half hour; wash and dye to shade with aniline bismark.

No. 103.—*Bismark Brown, another way* (100 lbs.).

Dissolve the aniline color, then add 5 pounds Glauber's salt, enter at 150° F., and bring on to the boil. Continue the boil till the color is taken up.

No. 104.—*Acid Bismark Brown* (100 lbs.).

Prepare with 1 pound alum, 1 pound tartar, 1 pound sulphuric acid; boil half an hour, then lift, and add the color to the same bath, and boil to shade.

No. 105.—*Acid Brown, another way.*

To 100 pounds of goods dissolve 5 pounds Glauber's salts at the boil, then add 2 pounds of oil vitriol and sufficient color to the shade required, and boil till the color is taken up.

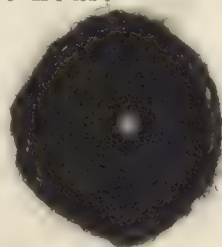
No. 106.—*Aniline Brown.*

On wool goods, orange and induline will produce light shades on the bismark hue, or dark ones on a flat or gray hue, and redder shades can be gotten by adding acid claret on maroon. It is worked on with about 1 pound of sulphuric acid to every pound of color.

No. 107.—*Deep Seal Brown* (220 lbs.).

Mordant for two hours, with 6 pounds of chrome, $3\frac{1}{2}$ pounds of bluestone, and the same of argols.

Dye with 110 pounds fustic, $16\frac{1}{2}$ logwood, 22 pounds sanders, and 22 pounds madder; boil two hours, then sadden with 9 ounces of copperas; boil in one hour.

No. 108.—*Olive Brown on Wool.*

For 50 lbs:—

Preparation	$1\frac{1}{2}$ lbs. chrome,
Dyeing	7 lbs. fustic,
	3 lbs. madder,
	1 lb. logwood,
	2 lbs. tartar,
	8 ozs. cudbear.

One run, raise in the second with 5 or 6 ozs. bluestone; wash well and dry.

No. 109.—*Common Dark Brown on Wool.*

For 40 lbs.:—

3 lbs. logwood,
12 lbs. redwood,
6 lbs. madder.

Boil half an hour, air out, and repeat; then sadden with one pound of copperas. If too dark, raise to pattern with muriate of tin.

No. 110.—*Woollen Yarn Brown* (5 kilos.=11 lbs.).

Mordant with 50 grams (1.75 ozs.) chrome, 20 grams (0.7 oz.) bluestone, 500 grams (17.5 ozs.) cream tartar, 25 grams (0.87 oz.) oil vitriol; boil half hour, then wash. Dye with 100 grams (3.5 ozs.) fuchsine, 100 grams (3.5 ozs.) orange, and 1 kilo. (2.2 lbs.) logwood. We hardly need add that the proportions of yellow indicated for these kinds of colors are by no means absolute; they have indeed to be left to good judgment of the dyer.

No. 111.—*Brown One Dip on Woollens.*

80 per cent. cutch, $7\frac{1}{2}$ per cent. extract fustic, 10 per cent. bluestone, 7 per cent. chrome, 4 per cent. concentrated archil. From 5 to 20 per cent. of oxalic acid to be added at the time of using, according to light or flat shade required.

Goods require boiling in from one-half to two hours according to shade. As the above preparation will dye from drab to brown, almost any of the woods or barks can be introduced to change the shade, such as redwood, barwood, and cudbear for red shades, fustic or flavine for yellower shades, logwood for darker shades.

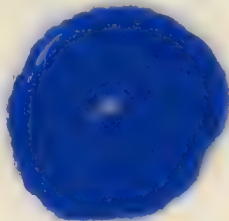
The bath can be continuously used, as it does not exhaust.

The same dye beck can be so changed that for such work as carpet yarns it can be used for any color almost except blue in light shades. I studied this question out to such a fine point, that after I had dyed the browns in it, I gradually got it up to a yellow, having obtained all the intermediate shades between, then up to scarlet with all the intermediate shades of salmon and orange,

then from full reds to maroon, claret and mulberry, from that to brown and green, then black, and from black to dark blue, gradually coming back to the shade of brown I started from. I have pattern books now with the above results in and printed instructions how accomplished.

No. 112.—*Victoria Blue Fast* (100 lbs.).

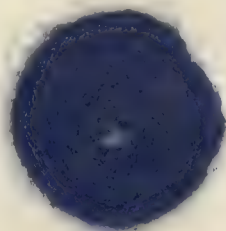
Dissolve 2 pounds Victoria blue and add 10 pounds Glauber's salt. Start at 150 and bring slowly up to boil; boil till all the color is taken up. This color will stand soaping. Lighter and darker shades are made in this blue.



No. 113.—*Dark Shades down to Navy*

can be gotten by preparing in 2 pounds chrome, 2 pounds bluestone, 2 pounds argols or 5 of alum, and giving a logwood bottom.

This blue is to be had on the green or red shade, and for flannel or hosiery goods that have to be washed is just the thing, as it does not change so much as alkali blues.



No. 114.—*Prussiate Blue* (20 lbs.).

3 pounds of prussiate, 3 quarts of blue spirits. Enter cold and bring to a quick boil, boil one-half hour, lift and add 1 quart of finishing spirit. If to stand fulling and steaming, 1 quart of ammonia should be added at the start, and if a darker shade is wanted add logwood with the finishing spirit.

No. 115.—*New Prussiate Blue.*

Whatever quantity of wool or woollen goods is to be dyed, take 8 per cent. of red prussiate and the same weight of oil vitriol. Enter at 150° F., and raise slowly to a boil which is kept up for half an hour, then lift and add to the same bath $\frac{1}{4}$ per cent. of acid magenta, and the same weight of tin crystals, and enter for half an hour.

For evenness of shade part of the liquor may be run off and cold water added before the goods are entered into the magenta liquor. For other lots less oil of vitriol and magenta will be required.

No. 116.—*Splendid Blue, Full Shade.*

As bright a blue as can be desired and that will not smut can be dyed on silk or wool, with extract of indigo, and acid magenta, using just enough of the latter to give it the desired red shade. It works on with sulphuric acid.

No. 117.—*Indigo Blue on Wool for Topped Hosiery.*

100 pounds of wool are colored with 3 pounds of Bengal indigo, in the woad or soda vat. There is then prepared, by boiling for a few minutes, 5 pounds of cudbear, or 8 pounds of orchil paste, adding to the mixture $\frac{1}{2}$ pound of soda ash. The beck must be cooled to 170° F. before the wool can be entered. It should be handled for twenty minutes, taken out, rinsed, and dried; 3 ounces of aniline purple can be used instead of the cudbear. The shade produced is very pretty, but ought never to be used for mixed goods which have to be bleached, as it runs into whites; the cudbear too is affected by sulphuring.

No. 118.—*Dark Blue for Broadcloth.*

A healthy woad vat is employed for this color; the wool is handled slowly for one hour, then removed. After two hours it can be again dipped until it has acquired the desired shade. Enough indigo should be added to the vat to color the wool in three immersions, that is, about 10 pounds of good indigo to 100 pounds of wool. The wool may with advantage be taken through

a warm bath containing 2 pounds of sulphate of copper. This additional immersion renders the color faster in fulling. A dark blue, very common in the market, is topped with camwood or red sanders, the latter being boiled on the wool.

No. 119.—*Process for Producing Mill-fast Alkali Blue on Wool.*

The introduction of alkali blue in cloth dyeing has hitherto been prevented because of the running of the color in the milling. A simple process has been discovered for remedying this defect. It consists in adding to the second or acid bath some sulphate of zinc, but in other respects working just as before. By using chemically pure sulphate of zinc the same beautiful tints are obtained as without this addition.

No. 120.—*Dyeing with Nicholson or Alkali Blue.*

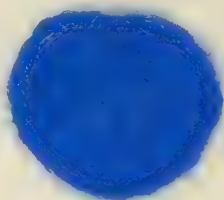
About 1 per cent. of color is the average, but as the bath does not exhaust, from 4 to 8 ounces extra for full shades are required at the start, to from 1 to 6 pounds of borax or sal soda, according to the hardness or softness of the water. Some use no alkali at all when the water is soft. Goods should be entered at 150° F., and brought up to the spring (some boil it) for half an hour. It is then drained, and as a precaution against its being uneven, when in the piece it is best to give it a wash which will free it from scum or other matter, which, if not cleared away, produces dark places which the dyer often cannot account for, and which show as soon as it has been rinsed.

To raise the blue, which is at this time only a pale bluish-gray, make up a bath, preferably just out of the cold, but cold will do, into which put about 2 quarts of sulphuric acid, into which the goods are placed and well opened until quite even and a bright color.

If the goods have to be fulled, then after dyeing follow the instructions given above, by adding the zinc to the acid bath.

For general purposes 3 or 4 B. blue is mostly used, and for darker 1 or 2 B., and for darker shades still Guernsey blue.

For other blues see receipts on silk dyeing, all or nearly all of which will answer for yarn or wool that does not require to stand fulling.



No. 121.—*Puteaux Blue for Woollen Goods.*

A very dark blue, said to be fast, and like most substitutes for indigo, said to be cheaper—it certainly can be dyed quicker—which should be in a wooden vat with lead steam-pipe. The following process has been supplied by the agent:—

Whatever be the weight of goods, use 3 per cent. of oxalic acid, boil the goods fifteen minutes, then stop the boil and add 4 or 5 per cent. of ammonia, and the color 10 per cent., then boil forty-five minutes. The goods should then be a light violet, then add 4 per cent. of oxalic acid. The bath will now turn blue. Boil one and a half hours. Then let it lie in water fifteen minutes in which acetate, sulphate, or chloride of zinc 4 per cent., and 2 per cent. of sulphuric acid, have been added at 50° C. (122° F.); then wash.

When required to be fullered give it fifteen minutes boil in 4 per cent. of nutgalls and 2 per cent. of acetic acid.

It is claimed that one-half the ingredients will do the next lot in same bath.

The dyeing should always commence with a violet shade, that is, the ammonia should prevail, and end with a blue shade (the acid prevail).

Should the bath precipitate through excess restore it with ammonia, but not too much, as the goods do not take up the color unless the bath is slightly acid.

No. 122.—*Soda or Potash Vat.*

By boiling 10 pounds of indigo in a solution of 4 pounds of caustic soda or potash, and adding 2 pounds of feathered tin or 3 pounds of tin crystals, the indigo is deoxidized by the strong affinity of the tin for the oxygen. The ordinary method of fermentation

is, however, to be preferred, as a large quantity of work can be passed through, but the soda vat is preferable for light blues, as a brighter color is obtained than by the woad vat, while larger quantities of goods may be colored more easily. Potash should be employed for linen and cotton.

No. 123.—*A Decomposed Vat.*

A decomposed, or as it is termed a "sick or green" vat, may be known by its dark color and freedom from odor, and more certainly by the addition of lime, bran, madder, and soda, or of woad. If, after several hours, the vat is restored, it may be worked with care as a new vat.

No. 124.—*Indigo Vat on a Small Scale for Woollen and Cotton Goods.*

Have a strong 9 gallon cask; put into it 8 gallons of chamber lye; have a 4 quart pickle jar, into which put 1 pound of ground indigo, and 3 pints of best vinegar. Put the jar into a saucepan, fill it with water, and make it boil well for two hours, well stirring it all the time; then let it stand in a warm place three days; then pour it into the chamber lye; rake it up twice a day for a month. It must be kept covered from the air.

No. 125.—*Blue on Woollens, Woad or Indigo Vat.*

Woad alone was used for coloring wool blue before indigo was introduced in Europe. The introduction of indigo was a great advantage to the dyer, not only for its intrinsic value, but because he could daily strengthen his vat, using the old woad as a fermenting agent, like yeast in making bread. As to the practical value of the different varieties of indigo, it may be said that 4 pounds of good Bengal are equivalent to 5 pounds of good Guatemala indigo.

In order to color with indigo we have to deprive it of its oxygen. The deoxidized indigo is yellow, and in this state penetrates the woollen fibre. The more perfectly the indigo in a vat is deoxidized, the brighter and faster will be the color. To a vat 8 feet deep by 6 feet wide, filled with water, and heated by steam or otherwise to 140° F., add 200 pounds of woad, about 10 pounds of well-ground indigo, or more according to the amount of work

to be done; 5 pounds of soda, $\frac{1}{2}$ bushel of good wheat bran, 10 pounds of good madder, and 1 pound of good flour. If the soda, bran, madder, and flour are boiled for five minutes before adding them to the vat, it will ferment twelve hours earlier than it would otherwise do. Stir the vat well, and after eight hours' rest, again stir the vat. By this time it should have commenced to ferment, the liquid acquiring a mottled appearance. When the fermentation is well established add about 2 pounds of slaked lime, and again stir; if sufficient lime has been added, the surface of the vat will reflect a golden color, and a sample of wool immersed in the liquid for about twenty minutes should become perfectly colored blue in one minute after it has been exposed to the air. A green color remaining with the wool after one minute shows that more lime should be added; should this addition be neglected, the vat will be as it is technically termed "lost." The lime added should be mixed with water and the solution filtered.

A vat, to which too much lime has been added, or which has become "over-sharpened," acquires a brown color, and the wool immersed in the liquor is imperfectly colored a gray blue; 2 or 3 pounds of sulphuric acid may be added in such a case to form with the lime a neutral sulphate, which settles to the bottom of the vat. After the addition of the sulphuric acid a mixture of 3 pounds of bran and 5 pounds of madder, boiled together, should be added; fermentation is thus again set up and can be reduced by lime as before. When the vat is exhausted, and more indigo must be added, care should be taken that the liquor is sharp enough. The liquor should again be warmed, and the indigo added, with about 6 pounds madder, 6 pounds of bran, and 2 pounds of soda, boiled together as before. The indigo should be added over night, in order that fermentation may be complete by the morning. In the morning, lime must be added until the golden film forms on the surface of the liquid.

No. 126.—*Topping Indigo Blues.*

Sometimes the goods came out of the vat on the green or gray hue; especially is this the case with wool used for blue that has been carbonated, called extract.

Acid magenta will correct it.

No. 127.—*Logwood Blue* (200 lbs.).

Prepare with 1 pound chrome, 4 pounds alum, 1 pound argol, boil one hour, drain well, but need not wash. Dye with 34 pounds best logwood chips previously well boiled in a bag; boil in this from forty to sixty minutes.

No. 128.—*Topped Logwood Blue on Vat Ground.*

Dip in the blue vat and then rinse, boil the wool thus dipped for one hour in a kettle containing 10 pounds of alum, 2 pounds of crude tartar, and $1\frac{1}{2}$ pounds of sulphate of copper, remove and cool. To some fresh water add 5 to 10 pounds of logwood, according to the shade required, and the quality of the logwood, in a bag. Boil and then cool the kettle to 170° F. The wool may now be entered and handled slowly; in one hour it may be cooled, rinsed, and switched for drying.

To prevent the edges of indigo cloth turning white it should always be topped.

No. 129.—*Indigo Blue, part Logwood.*

For 100 pounds of cloth, color the cloth in the indigo blue vat, and rinse well; then boil the cloth in a bath of 20 pounds of alum, 2 pounds of tartar, 5 ounces of tin crystals for two hours; remove and cool. To a kettle of fresh water add 10 pounds of logwood in a bag, boiling for half an hour, cool to 170° F., and enter the wool, boiling half an hour; cool and rinse.

No. 130.—*Dark Blue.*

For 5 kilos. (11 lbs.), boil with 50 grams (1.75 ozs.), bichromate of potassa, 20 grams (0.70 ozs.) blue vitriol, 500 grams (1.1 lb.) cream of tartar, and 25 grams (0.87 oz.) sulphuric acid; let it get cool in this bath and wash, then dye with a decoction of $\frac{1}{2}$ kilo. fustic and 100 grams (3.5 ozs.) fuchsine. Let it boil in this bath for half an hour. The color may be deepened if desired by adding a trifle of logwood.

No. 131.—*Logwood Blue on Wool in One Bath* (220 lbs.).

Boil out 10 pounds chip logwood for half an hour, add to it 22 pounds alum, 4 pounds 6 ounces argol, 2 pounds 3 ounces blue-

stone. When dissolved enter at the boil, and boil for three hours. It is then well washed and left to drain while 40 pounds of logwood are boiled out. The wool is then entered and boiled one hour, it is then lifted and washed, $2\frac{1}{2}$ pounds bluestone are then added, the wool is now entered for half an hour, it is then dried and washed.

N. B.—As logwood blue always has been dyed in two baths mordant first and logwood separate, I made some tests of the above process, and while it certainly made some kind of dark gray blue it did not equal the separate baths process.

I tried it one hour first bath and did not wash at all before giving the logwood or when it came to the bluestone, and obtained about as good results. I therefore give it as it may serve for cheap goods.

No. 132.—*Indigo Dyed Cloth, how to Improve so that it will not wear White.*

It is a well-known fact that cloth dyed in the indigo vat turns white on the edges, and seams or other parts by hard wear; this can be perfectly prevented by the following plan.

Dye first in the vat to a full skyblue, then mill and wash, then boil out for 66 pound goods about 5 pounds logwood, add to it alum 4 pounds 6 ounces, red argol 18 ounces, bluestone 4 pounds 6 ounces, enter and stir well for two hours, then lift and add 8 or 9 pounds more logwood, boil it quarter of an hour, then enter the goods and boil one hour, then lift and cool, boil out 8 pounds more logwood, and then add 1 pound bluestone and $\frac{1}{2}$ to 1 pound of copperas, re-enter and boil till dark enough.

No. 133.—*A More Expeditious Way (33 lbs.).*

Boil out 55 pounds logwood one-half hour, then add to the beck 2 pounds 3 ounces crystals of tin, 17 ounces alum, 17 ounces red argol, enter and boil one and a half hours (this supposes the cloth to have been in the vat as described in the last). It is taken out and aired. Then dissolve 7 ounces bluestone, boil in this for quarter of an hour, or for thick clothes longer, then take out, air, and wash.

N. B.—Considerable indigo may be saved by topping as above directed, besides the advantage of the cloth never wearing white, or turning red as logwood blues do, and, moreover, it is even brighter and stands the indigo test.

Having no vat I tried giving it a bottom of extract of indigo, and had excellent results.

I also found that by using about half the quantity of tin with the other ingredients I obtained a very good blue in the one bath without the indigo bottom, the amount of logwood given regulating the depth of shade, the color being every way preferable to No. 127.

I would here observe that goods that have taken the blue in the vat unevenly may by the above process be made perfect.

No. 134.—*Bird's Victoria Blue, one Dip.*

This blue is suitable for wool and silk especially, but it will take with less mordant than most other blues on cotton or almost any substance of a fibrous nature.

It is made in several different shades, from medium to dark, on either a green or red cast.

It only requires dissolving, and the wool or silk takes up the color quite easily with Glauber salts. It smuts but very little, and will bear good soaping, which improves it.

Although not quite so bright as 4 B. alkali blue, yet it is a good color and dyed easier.

No. 135.—*One Dip Black on Wool.*

100 per cent. ex. logwood, 5 per cent. ex. fustic, 20 per cent. bluestone, 15 per cent. copperas, 5 per cent. alum, 5 per cent. argols, 1 per cent. chromate of potash. 20 pounds of this mixture to 100 of goods; boil till black.

For brown use less of the mixture and more fustic and archil to shade.

Navy blue: use 10 pounds of the black, and serge blue to shade.

No. 136.—*Jet Black for Wool.*

For 50 pounds prepare with $1\frac{1}{2}$ pounds chrome; boil half an hour, and wash in two waters. Dye in a separate bath with 20 pounds of logwood and 2 pounds fustic; boil half an hour; one

water, then a slight sour, moderately warm; one cold water, and finish out of a warm one softened with a little urine.

Note.—A pound of wool woven into merino or cashmere measures about 3 yards, common moreen about 2 yards.

No. 137.—*Fast Black on Wool* (50 lbs.).

Prepare with 2 pounds of chrome, 1 pound tartar, and 1 quart muriate of tin; boil one hour, and wash in two waters.

Dye in separate bath with 25 pounds logwood and 3 pounds fustic; boil thirty minutes, lift, add one pint of vitriol, return for ten minutes, then wash and dry.

This black stands fulling, or acid and alkaline tests, and is good to mix with light colors.

No. 138.—*Fast Blue-Black for Wool*.

Same as the previous receipt (Fast Black, No. 137), but without fustic.

No. 139.—*Milling Black for Woollen Yarn* (100 lbs.).

Boil for half an hour with $3\frac{1}{2}$ pounds chromate potash and $2\frac{1}{2}$ pounds red argol; rinse, and dye in fresh bath with 50 pounds logwood and $2\frac{1}{2}$ pounds sulphuric acid, and rinse; return it to the first beck; give four turns, and rinse again.

No. 140.—*New Aniline Black for Dyeing Woollens*.

Although aniline black for dyeing woollens has been tried repeatedly in this country, it has not up to the present been crowned with success; nevertheless it is well to mention the following process, but at the same time to say that though the color produced by it is of a deep and very bright black, extremely fast, and stands without altering its color in the least, both in stoving and bleaching—it is feared its price at the present will be an obstacle to its general adoption; yet it is hoped that with the continual and rapid improvements made in this particular branch of chemical science, this color also will soon have its place in dyeing establishments.

To dye 2 pounds of wool, 3 ounces of permanganate of potash and $4\frac{1}{2}$ ounces of Epsom salts are to be dissolved in five gallons of

hot water. When cool the wool is to be put into the liquor, and allowed to remain in it until it has taken up nearly all the color of the dye bath, or until the latter only looks slightly yellowish. The wool will partake of a dark brown color. Press, and without washing, put it into a cold bath prepared with 12 ounces of aniline oil, 20 ounces of spirits of salts, and 2 gallons of water; the wool will appear directly of a dark green color; press, and wash it in water which contains a little soda; then it is to be put into a weak solution of bichromate of potash ($\frac{1}{3}$ of an ounce of bichromate for $2\frac{1}{2}$ gallons of water) in which the wool will acquire a deep black color. After this last bath wash and dry it.

Note.—The aniline bath must not be thrown away, but kept as a permanent vat, and needs only from time to time to be replaced by aniline oils, etc.

No. 141.—*Cloth Black* (25 kilos.=55 lbs.).

Boil for three-quarters of an hour with 875 gr. (30.62 oz.) of chrome, 100 gr. (3.5 oz.) of bluestone, 300 gr. (10.5 oz.) of tartar, 200 gr. (7 oz.) sulphuric acid; then wash.

Dye with 15 kilos. (33 lbs.) of logwood and 2 kilos. (4.4 lbs.) of fustic; boil three-quarters of an hour.

No. 142.—*Black Dyeing of Blue Cloth.*

In dyeing blue cloth black it is usual first to boil the cloth in a decoction of nutgalls, and then in a bath of sulphate of iron. To impart a full black rich tint some logwood is added to the nutgalls, and a decoction made from this mixture is used as a first bath for the cloth. To renovate rusty black cloth, make a decoction of logwood by boiling 2 ounces in $1\frac{1}{2}$ gallons of water for half an hour. Wash the cloth thoroughly in warm water, wring it dry, boil it in the logwood solution for half an hour, then take it out for a few moments, and stir in 150 grains of sulphate of iron; return the cloth to the bath, and boil for half an hour longer, then take it out and hang up to dry without wringing. After it has hung for a few hours, rinse it thoroughly in several waters (cold) and then well dry it.

No. 143.—*Fast Black on Wool.*

After the wool is thoroughly washed and cleaned, put it in a logwood bath, the stronger this bath is the better, and boil it for about one hour. Take the wool out and let it drain, and put it in bichromate of potash and keep it there for about five minutes at a temperature of about 150° F. For shading it, use quercitron, after which wash well in clean cold water.

This black stands acid and alkalies, exposure to air, and also milling. I cannot give proper quantities, as the same have to be altered according to the kind of wool and water, but any practical dyer will soon find out the proper proportions.

No. 144.—*To Dye Flannel Black and Red, Fast (22 lbs.)*

Dye a fast black first as follows:—

Logwood 33 pounds, fustic 11 pounds, argol $4\frac{1}{2}$ pounds, alum $2\frac{1}{2}$ pounds. Boil out the woods first, then dissolve in same bath the argols and alum, enter the goods at 190° F., and bring to a boil, boil one and a half hours. Lift and sadden with $4\frac{1}{2}$ pounds copperas, and 1 pound 2 ounces bluestone, boil half an hour, well wash and wring, and then dye in scarlet as No. 33, page 89.

Of course it is understood that it is the yarn or wool that is dyed the fast black first, then woven, and the scarlet then dyed.

The same black will do for other plaids, and stand fulling well.

N. B.—Bird's One Dip Black for Wool will answer the purpose equally well at less trouble and expense.

No. 145.—*Good Blacks from Bid Ones.*

Mixed goods when dyed are often found to be rusty from excess of dye. Take such and handle them in a boiling hot starch liquor for ten or fifteen minutes, say 1 pound to twelve dresses or 100 yards of stuff. This takes off the rust, brightens the black, strengthens the material, and fixes the dye. The starch must of course be quite thin and well strained. This has a splendid effect, as I know from personal experience.

No. 146.—*How to Obtain a Black on Goods that have been Overcharged with Chrome.*

This is one of the most difficult things to accomplish, as you may re-mordant and re-scour, but you do not thereby get rid of the chrome, and however strong the logwood, it will not blacken, as I have found by sad experience. But after many vain attempts I struck the secret, which is as follows:—

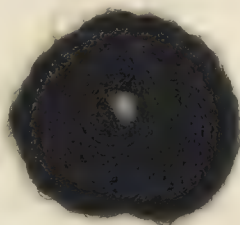
After a boil in strong logwood, lift, and to the same bath add a small portion of chromate of potash. This cures it; chromate is a very different article from chrome, so do not confound the two.

No. 147.—*Bird's Inexhaustible One-dip Black.*

(A vegetable dye for wool, wool extract, shoddy, old rags, felt, etc. (not for cotton)).

One pound of the color will dye 6 pounds goods a splendid black that will stand acid and fulling.

100 pounds goods, dissolve 40 pounds black paste in boiling water, run up the bath with cold to 100° F., then add 12 ounces oxalic acid, stir well, and enter goods; boil about two hours, or to shade. Half the quantity of dye, but the same of acid, for all after-lots. In dyeing old stock, such as wool extract, when acid has been used, no acid whatever should be used in dyeing, and if at the expiration of the time, it looks at all brown, gradually cast in enough alkali to kill the acid that has boiled out of the old stock; the result will be a splendid black. 15 pounds to 100 will dye old stock after starting with 20 pounds.



No. 148.—*Job Dyer's Bleach for Black on Woollen Goods.*

Some colors, especially violet and brown, and some strong scarlets, when colored black, look to have what is variously called a red hue, a bronze hue, and a rusty hue; some would say they are

badly dyed. Such, however, may not be the case, as it may be only the reflection of the old color showing through the new, which certainly is the case if the old colors were not killed, that is, giving them a soap and soda bath before dyeing, and further, if they have enough dye stuff on them, to prove which dissolve chloride of lime in warm water, and when settled strain off the clear liquor into a vessel large enough to allow the goods to be worked easily and openly in it.

This liquor should stand at about 100° F., and the goods run through it until the desired tone of jet black is obtained; a man soon learns how much lime to use. It is safe to start with little, and add more if required. This is not only the cheapest, but the most efficient method in use.

Besides it has the additional advantages that it brightens the black and prevents its smutting or crocking; garment dyers should put all goods of woollen texture through it to fix the dye, as if it is not too strong it never injures but improves it. Care must, however, be taken not to give garments with silk or cotton too much of it, as it strips the color quickly, but where the garment is all wool it will clean the linings nicely.

From the lime one wash will be sufficient.

SECTION IV.

FLANNEL DYEING.

As Madam Fashion has smiled so becomingly upon the softer kind of dress-wear in the shape of colored flannels, and as this choice is not wholly a fickle fancy, but possesses a wholesome propriety, which argues for a considerable run, I have endeavored to meet the necessity by supplying the formulas for the prevailing colors and shades called for.

As this change of fashion originated in France, I have procured the formulas from thence, so that by following them the same shades can be obtained here—with which some few others have been introduced.

ON DYEING WOOL FLANNEL GOODS IN THE PIECE.

The following receipts are for 5 pieces of flannel of 20 pounds each, making 100 pounds in weight. The vessels that these goods are dyed in should be very clean when light colors are to be dyed, and care should be taken to have the dyes well dissolved before entering the cloth in the bath. On adding the dyes to the bath it should be boiled up and then cooled down to a moderate heat. Then enter the cloth and turn it quickly for fifteen minutes, so as to give the dyes time to work even on the goods. Then the bath should be boiled up and kept at boiling until the proper shade is made. Then wash the goods off in a separate bath in clean cold water.

No. 1.—*B. B. Aniline Scarlet.*

Make up water bath and add to it the solution of 2 pounds of aniline scarlet, 4 pounds Glauber salts, 1 quart oil of vitriol, 2

quarts acetic acid; cool down, enter goods, and boil in the same bath one hour, and wash off.



No. 2.—*Maroon.*

Add to a boiling hot bath of water, 8 pounds cudbear, and cool down. Enter yarn, and keep it in motion for half an hour; then make up another bath, and add to it 2 lbs. cochineal, 3 quarts of nitrate of tin, 6 pounds of tartar. Enter in this, and work them in it for one hour, or until the shade is produced. If a darker shade is required use less cochineal in the bath.

No. 3.—*Claret.*

Make up a bath of boiling hot water and add to it 5 pounds of alum and 4 pounds of logwood. Cool down, and enter the cloth and keep it in motion for an hour and a half, and then finish in another vessel with 30 pounds peachwood, and 1 quart ammonia. The goods should be boiled one hour in the bath, and afterward washed off. Darker shades can be produced by adding more logwood with the alum.



No. 4.—*Dark Green Olive.*

Prepare dye-bath with 12 pounds turmeric, 2 quarts oil of vitriol, 5 pounds tartar, 2 quarts sulphate of indigo. Boil up well, and cool down; enter goods; turn six times. Boil up quickly, and continue for forty minutes, and wash off well.



No. 5.—*Light Olive Green.*

Prepare dye-bath with 4 pounds turmeric, 1 quart oil of vitriol, 4 pounds tartar, 1 pint sulphate of indigo, and work in respects same as dark shade.

No. 6.—*Regular Shade of Green.*

Make up bath of boiling hot water, and add to it 5 pounds fustic, 4 pounds of red tartar, 12 pounds alum, 3 pints of sulphate of indigo; cool down the bath, and enter the cloth, and work for an hour and a half boiling and wash.

No. 7.—*Sea Green.*

Prepare the dye-bath with 5 pounds alum, 4 pounds argol, 12 pounds of fustic, 1 quart extract indigo. Boil up the bath well; cool down; enter the cloth, and keep it in motion twenty-five minutes; then boil up, and keep in one hour; wash off.

No. 8.—*Invisible Green.*

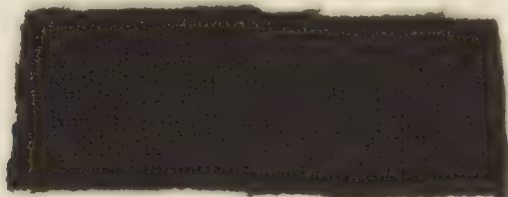
Prepare dye-bath, boiling hot, with 3 quarts of sulphate of indigo, 8 pounds logwood, 15 pounds alum; cool down, enter goods, and boil for an hour and a half, and then wash off well.

No. 9.—*Light Brown Olive.*

Prepare dye-bath with 12 pounds turmeric, 18 pounds camwood, 2 pints of sulphate of indigo, 2 quarts oil of vitriol, 6 pounds of red tartar; boil up, then cool, enter, and work, boiling for one hour, and then wash off in clean water.

No. 10.—*Seal Brown.*

Prepare dye-bath with 25 pounds peachwood, 12 pounds turmeric, 8 pounds logwood, 4 pounds alum, 3 pounds blue vitriol; enter goods, and work same as olive brown.



No. 11.—*Sky Blue.*

Add to a bath of water, boiling hot, 15 pounds Glauber salts, 2 gills extract of indigo, 1 ounce serge blue, 3 pints vitriol. Cool down, enter cloth, and boil one hour, and wash off.

No. 12.—*Aniline Blue, Light Shade.*

Add to a boiling hot bath of water 1 pound of aniline soluble blue, 1 quart oil of vitriol; have the blue well dissolved; cool down, and enter cloth, and bring quickly to boil; boil one hour.

No. 13.—*Medium Shade of Blue.*

Prepare dye-bath same as for light shade, only use 2 pounds of aniline blue, 2 quarts oil of vitriol in place of 1 pound. The bath is worked the same. Darker shades can be still made by adding induline blue with the soluble blue.

No. 14.—*Crimson.*

Make up a bath of hot water, and add to it 3 pounds of lac, $1\frac{1}{2}$ pounds cochineal, 5 pounds paste cochineal, 6 pounds red tartar, 6 quarts nitrate of tin. Boil up the bath well until the dyes are well dissolved; then cool down, and enter the cloth, and turn quickly for twenty minutes; then heat up and work until the bath is taken up, boiling all the time, and then wash off in water.

No. 15.—*Aniline Crimson.*

Add to a bath of water the solution of $2\frac{1}{2}$ pounds of aniline scarlet, 1 quart oil of vitriol, 2 ounces acid magenta. Enter goods at 100° ; run twenty minutes, then heat up to a boil gradually, and boil half an hour, and then wash off in separate bath of clear water.

No. 16.—*Acid Magenta.*

Dissolve 12 ounces of acid aniline magenta crystals in a separate vessel, and add the solution after it is strained through a cloth or sieve with 1 pint oil of vitriol. Enter cloth, and work at a boiling temperature for three-quarters of an hour, and rinse off.

No. 17.—*Silver Drab.*

Make a bath of water and add to it 1 quart oil of vitriol, 12 pounds Glauber salts, $3\frac{1}{2}$ ounces paste cudbear, 1 gill sulphate of indigo. Boil all up together well, cool down to 150° ; enter and boil three-quarters of an hour while turning, and wash off.

No. 18.—*Darker Shade Drab.*

Add to a bath of clean water 1 quart oil of vitriol, 3 ounces cudbear, 6 pounds mull madder, $\frac{1}{2}$ gill sulphate of indigo. Heat up, and enter cloth same way as for silver drab.

No. 19.—*Violet.*

A full shade of violet can be made in the following manner: Dissolve in an earthen vessel 1 pound aniline violet to 12 gallons of water. Strain off $\frac{1}{2}$ of the solution—that is 6 gallons, and add it to a bath of clean water, with 1 pint oil of vitriol, 2 pounds of soda crystals. Enter the cloth, and work boiling hot for one hour. Wash off.

No. 20.—*Blue Black.*

Make up a bath of water and add to it 2 pounds argols, 2 pounds of chrome. Enter the goods in this, and keep them in motion for one hour, and rinse off. Then finish them in another bath, to which 40 pounds of logwood have been added. Boil one hour in this bath, and wash off in water.

No. 21.—*Full Black.*

Make up bath of water and add 2 pounds chrome; boil one hour, and finish in another bath with 40 pounds logwood and 10 pounds of fustic. Boil one hour, and wash off; if not dark add more logwood to the bath.

No. 22.—*Alkali Blue.*

Prepare dye-bath with the solution of 1 pound of alkali blue 4 B., with 10 pounds of soda or borax. Enter, and keep in motion for three-quarters of an hour at a boil. Then lift out, and enter another bath of cold water to which 2 quarts oil of vitriol have been

added. Work in this cold bath until the color is fully developed, then rinse off in cold water.



No. 23.—*Aniline Navy Blue.*

Make up a bath of water and add to it the solution of 2 pounds aniline navy blue, 1 pound induline blue, 2 quarts oil of vitriol. Boil the bath up well before entering. Cool down to 150° F., enter the cloth, and turn for one hour at a boil; then wash off in cold water. If this shade of blue is not dark enough add more induline blue to the bath, as it is a substitute for indigo and a fast color.



No. 24.—*Night Green.*

Make up a bath of water boiling hot and dissolve 14 ounces of acid green crystals in an earthen vessel, strain off the solution and add it to the bath, and with it sufficient picric acid, or fustic enough to yellow them to the shade required. Enter the cloth, and work until the shade required is furnished. If the shade is not yellow enough add more picric acid to the bath. By varying the amount of green and picric acid any shade of night green can be produced. The cloth should be well washed off from the dye bath and dried right away, as better results can be made by drying them right from the washing machine.

No. 25.—*Peacock Blue.*

Make up a bath of water, 9 pounds of indigo extract, 2 quarts oil of vitriol, 1½ pounds picric acid, 10 pounds Glauber salts.

These dyes should be dissolved in a half bath of water. After dissolving well, fill up with cold water, enter the cloth, work twenty minutes, then boil up quickly, and keep boiling for one hour or until the bath is exhausted. Then wash off in clean water and dry.

No. 26.—*Cardinal Red.*

Dissolve in a half bath of water 1 pound fast red, 10 ounces of acid magenta crystals, 12 pounds Glauber salts, 2 quarts oil of vitriol. Boil up in this way until they are dissolved. Cool down; enter cloth, and bring slowly up to a boil, and work that way one hour.

No. 27.—*Dark Fawn Color.*

Add to a bath of boiling water 12 pounds fustic, 4 pounds red tartar, 5 pounds alum, 4 pounds archil, 2 pounds indigo extract. Cool down the bath, enter the cloth, and work twenty minutes; then heat up to a boil, and boil one hour, and wash off in cold water.

No. 28.—*Darker Silver Drab.*

Add to clean bath of water at boiling point, 10 pounds of super argol, 1 quart oil of vitriol, 10 ounces of cudbear, three-quarters of a gill of sulphate of indigo; the goods should be entered at a boil, and kept in motion for one and a half hours, and afterwards wash off well in clean cold water.

No. 29.—*Bottle Green.*

Add to a clean bath of boiling hot water, 25 pounds fustic, 20 pounds of alum, 10 pounds of red argol, 4 pints of sulphate of indigo, enter the goods at boiling point, and keep them in motion for one hour at boiling point.



No. 30.—*Mauve Color.*

Add to a bath of water the solution of 4 ounces violet purple and 1 pint of oil of vitriol, enter the goods and boil one hour; this makes a nice shade, and is a cheap and quick way.

No. 31.—*Dove Color.*

Dye off in a clean vessel partly filled with clean water boiling hot, 1 pound of paste cochineal, 8 pounds of tartar, 1 pint extract of indigo, enter goods at boil and work boiling hot for one hour.

No. 32.—*Lavender.*

Dye off in a clean vessel to which 1 pint of indigo extract, 1 pound of paste cudbear, 10 pounds of Glauber's salt, 1 quart of oil of vitriol have been added, bring the bath quickly up to a boil and enter the goods and keep in motion for one and a half hours, take out and wash off well in clean cold water.

No. 33.—*Red Shade of Lavender.*

Dye off in clean vessel with 1 quart of oil of vitriol, 10 pounds of Glauber's salt, 2 pounds of cudbear, 1 pint of extract of indigo, boil well in this bath one and a half hours.

No. 34.—*Brown Olive.*

Add to a bath of boiling hot water, 3 pints of oil of vitriol, 12 pounds of red argol, 2 gills sulphate indigo, 15 pounds of camwood, 12 pounds of turmeric, enter the goods in this bath, and boil one and a half hours, take out and wash off.

No. 35.—*Green Olive.*

Dye off in a clean vessel partly filled with clean water boiling hot, to which there have been added 3 pints of oil of vitriol, 12 pounds of red argol, 6 pounds of camwood, 1 pint sulphate of indigo, 12 pounds of turmeric, and keep boiling in this bath for one and a half hours; take out and wash off.

It will be readily understood that while the above formulas are good for flannel they can be used for many other purposes.

Victoria is a fine blue for flannel; see particulars in woollen yarn blues.

It is made in as many shades as Nicholson's blues, and as soon as dissolved is ready to dye without any mordant, and will stand washing very well. It is \$3.50 per pound, 1 pound will dye from 50 to 100 pounds according to shade.

SECTION V.

FELT PIECE DYEING.

WOOL felt can be dyed in the same way as flannel.
Wool front and cotton back in the same way as mixed goods.

No. 1.—*Scarlet* (60 lbs.).

Wool and cotton mixed as follows:—

Mordant in 15 pounds sumac, then run through oxymuriate of tin or oxymuriate of antimony, 2° Tw.; wash well.

Dye with 12 ounces cotton scarlet and 12 to 16 ounces wool scarlet in one bath; commence at 100° and bring slowly to 200° F.

The amount of wool scarlet is regulated according to the amount of wool in it; as will be understood a larger amount of cotton, of course, requiring more cotton and less wool color.

And the scarlets are to be chosen according to the shade required, either yellow or blue.



No. 2.—*Bright Blue* (60 lbs.).

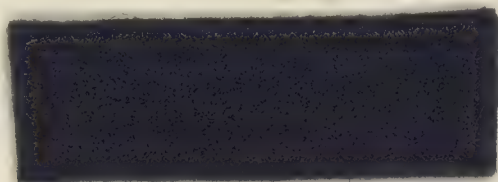
Prepare as for scarlet in mordant, and tin and wash.

Dye as for scarlet, only use 12 ounces or so of 4 B. blue; it will not matter what percentage of cotton or wool is used, this will color both through alike.



No. 3.—*Dark Blue.*

Dye the wool first with serge or cotton blue as directed for flannel; when dark enough wash off, and speck-dye the cotton—which means run them through a bath, at not over 100° F., of logwood and bluestone, using about 1 pound of the latter to about 20 pounds of boiled-out logwood chip liquor; it has to be a strong bath, and worked until the cotton is as dark as the wool.

No. 4.—*Another Way*

is to dye the wool first a logwood blue, for same see woollen dyeing; then speck-dye, which no doubt is a faster color than the former.

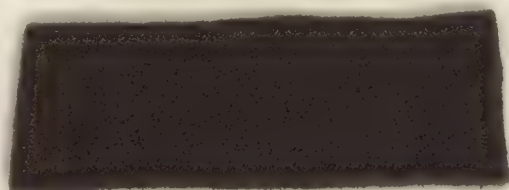
No. 5.—*Another Way*

which gives good results, is to use Bird's navy blue paste, which in one liquor, dyes both cotton and wool a deep gray-blue, and can be blumed to any shade with a run through a weak bath of violet. This method is very simple and very cheap, and makes a solid color.

No. 6.—*Brown.*

See brown on mixed goods for job dyers. That cutch way gives good results on felts.

See also brown on dress mixed goods from which felts can be dyed any shade of brown.



No. 7.—*An Excellent Brown*

can be dyed on felts in ninety minutes as follows:—

Mordant as for scarlet with 15 pounds sumac or 4 pounds Bird's No. 2 mordant at 12 cents per pound; then run through iron liquor and wash off in two waters.

And dye with Bird's cotton Brown which is four times as strong as Bismark.

For darker shades use logwood in with the dye, by which good, sound browns are produced.

No. 8.—*Cardinal.*

Take 14 ounces orange, 16 ounces acid magenta, 10 pounds Glauber's salt, and sufficient sulphuric acid to raise the color; the above should dye 100 pounds of wool felt.

For mixed felt prepare as for scarlet, and dye with roseine and cotton orange, phosphine or turmeric, or any other yellow.

No. 9.—*Claret.*

This color can be dyed in the same way as cardinal, only use acid claret.

2d. Prepare with 4 pounds argol and 4 pounds alum, and dye with cudbear or archil, using fustic or bark to yellow it if required.

3d. Prepare with 4 pounds argol, 4 pounds alum, 3 pints tin liquor, from which wash off.

Dye with hypernic and logwood to shade, in a fresh bath. This way looks good, but does not wear like the former.

Mixed felts are dyed by preparing them as for scarlet, and dyeing them with roseine and a little violet to shade.

4th. Instead of roseine and violet it can be dyed with hypernic and logwood, after the mordanting with argol, alum, and tin.



For other colors see wool or mixed goods.

SECTION VI.

MISCELLANEOUS WOOL DYEING, ETC.

ONE DIP DYEING OF EXTRACT.

No. 1.—*Extract Wool*

is the woollen part of old rags from which the cotton or other fibres have been separated.

As it is considered too much trouble to sort all the colors before the separation, they are consequently blended. On this blend it is difficult to produce the brightest of colors, and the ordinary methods of dyeing do not yield good results, which is certainly a branch by itself.

The lighter kinds are sometimes separated from the darker, and are called light stock, from which all except the very delicate shades of colors can be very well obtained by following woollen dyeing receipts, with, however, this reservation, they should be dyed in what are known as acid or tin dyes, which help to keep it bright, and previously to the color being added be sure that the stock is quite clean.

For the brightest of shades, let it have a good boil in for 100 pounds, say 4 pounds argol, and 3 of sulphuric acid, it will wonderfully help to lighten the color and be about all the mordant it will require.

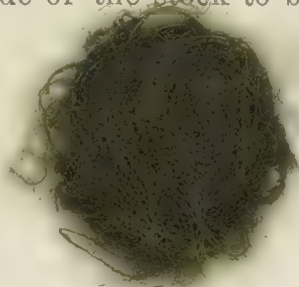
The other is called dark stock, and by boiling in the liquor named, is thereby much discharged and evened, so that it will take very good colors in maroon with acid scarlet, or claret with acid magenta, or for cheap claret with logwood, or logwood and hypernic, and green or bronze with acid green and yellow, or indigo extract and picric.

No. 2.—*Dark Yellow with Nitric Acid and Turmeric.*

I will now show 4 colors from light stock, and 6 from dark stock.

No. 3.—*Bronze.*

Dyed with extract of indigo and picric acid, with enough sulphuric acid added to take up the color, the proportion to be varied according to the shade of the stock to be dyed.

No. 4.—*Maroon or Fast Red.*

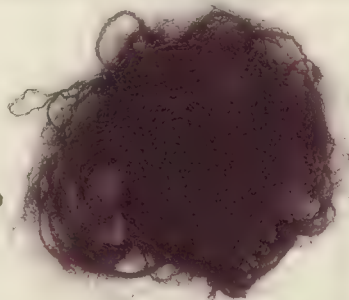
Equal parts of scarlet and acid magenta.

No. 5.—*Darker Fast Red.*

3 parts acid magenta, 2 parts scarlet.

No. 6.—*Claret.*

Dye with acid claret or with cudbear after preparation as above.



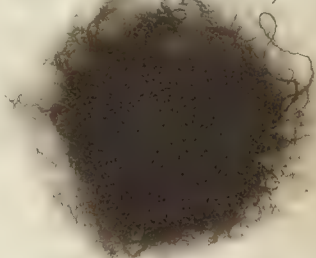
DARK EXTRACT STOCK.

No. 7.—*Light Brown* (100 lbs.).

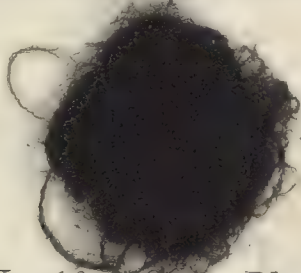
Dye with $\frac{3}{4}$ pound orange, and 3 pounds sulphuric acid.

No. 8.—*Medium Brown*.

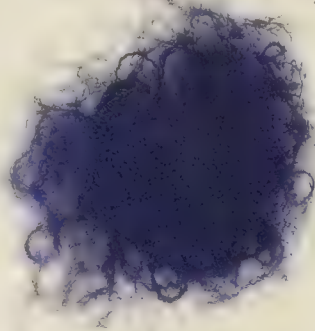
Dye with acid Bismark 1 pound, and 2 pounds sulphuric acid.

No. 9.—*Dark Brown*.

Dye with equal parts of orange and serge blue, or in place of the blue use logwood and 5 pounds of alum.

No. 10.—*Serge Blue* (100 lbs.).

Dissolve 1 pound color, and add 3 pounds sulphuric acid, commence at 150° F., and raise to boil, continue till the color is taken up.

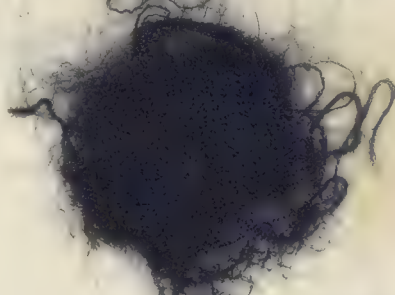


No. 11.—*Darker Blue.*

Same as last, only use 12 ounces serge blue and indigo paste to shade in the same bath.

No. 12.—*Navy Blue.*

Same as No. 10, only use 8 ounces serge and the balance indigo extract to shade.

No. 13.—*Worsted, Wool, Yarn, and Flannel Dyeing Mistakes Corrected.*

It is often urged that the formula that is good for one is not for the other. There is just enough of the salt of truth in this to keep the theory alive, but not enough to sustain the statement. I here purpose showing how much similitude and how little divergence there is in worsted.

1st. Worsted being the coarser kind of wool, and not being torn up as wool is, presents a surface that has been exposed very much more to the air and sun than has wool, and as a consequence what is tantamount to a tannin or mordanting process.

2d. The fibre being coarser than wool is naturally and actually a larger tube (hollow hair), and being such covers a larger surface than wool, which, in my judgment, are the principal reasons for worsted taking less dye than wool. So much for the divergence; now for the similitude.

Wool will be admitted to contain the same constituent elements as worsted in every particular, with only the difference of degree in the fineness of the fibre, and as a consequence the exclusion of

sun and air from its down-like soft tissue, which, when opened out, presents a whiter appearance. It therefore naturally follows, that wool will require a little more coloring matter than worsted, which I am bound to concede, having admitted that, I claim it is only a question of giving this extra allowance to the wool to obtain the same shade of color as upon worsted, and by making this allowance I still further claim that exactly the same formula that will dye worsted can in every instance be made to do duty for wool, flannel, and cloth, or other woven fabrics in the hands of any man of ordinary intelligence by a very little practice.

The fact being so, if you do not find just what you want in one department look in the other, and do as the fox does—appropriate what suits best.

No. 14.—*Yarn Dyeing Two Colors.*

The old plan of tying up every place wanted to be kept white was both tedious and costly, and at the same time made the yarn irregular. Woollen yarn is now dyed in blocks by the following process:—

A square bottom or stand is made to a convenient size both for the yarn and kettle in which it has to be colored; it is made quite strong, and at each corner an arrangement made for upright, inch-round rods of the depth of the kettle to stand in; upon this bottom wooden square blocks are placed the width of the space to be reserved white, they are placed at equal distances apart, and the yarn placed over them at equal distances apart also. Then other blocks are placed the reverse way upon the yarn, so that they are athwart and across. In this way it is built up until the desired complement is made, when a top goes on, and is a counterpart of the bottom; the rods are now placed in position and very firmly screwed down, as the upper end of the rod has a thread for a nut.

Where the blocks pass upon each other, no dye will get through, but as all the other parts are hollow intersections, the dye gets through them, and colors all the spaces or openings.

A crane is built near the end of the kettle towards the open part of the dyehouse where the block has been built, by which it is lifted, being fixed to attachments upon the block, and lowered into

the kettle which has been prepared with the desired color to receive it.

And to secure uniformity of shade an arrangement is made in the ceiling by which a weighted handle is connected that can be worked up and down like a blacksmith's bellows to give a rising and falling motion to the block. This agitation gives a chance to the dye to find its way to all the threads, and so produce an even result in coloring.

Cotton and mixed yarns are mostly printed with a machine, and I believe some woollen yarn also, but the block dyeing is of course the most permanent.

The object of this block dyeing is to produce on knitted goods a mottled surface, and is mostly used for hosiery.

SECTION VII.

SUBSTITUTES FOR INDIGO.

THERE are many on the market, and, as usual, each inventor is modest enough to claim that his process is the best.

It would therefore be invidious on my part to sit in judgment upon them, as I may have my preferences, which may by others be called prejudice. So keen are the claims and so strong the feeling, that I shall content myself with laying the principal ones before my readers, and they can procure for themselves the process and particulars from the inventors or their agents, whose names I have given for this purpose.

No. 1.—*Knab's Indigo Substitute.*

It is a dark blue coloring matter, which is said combines readily without a mordant on most animal and vegetable fibres in printing or dyeing.

It is made in paste and liquid form, but the paste is considered the most economical. It should be used with soft water, or, if the water be hard, add to it a little muriatic acid.

No. 2.—*J. R. Gergy's Indigo Substitute.*

This also can be used either for dyeing or printing.

No. 3.—*Artificial Alizarin.*

This new article being so much more easily obtained than by the old manner from madder, for Turkey red, etc., and giving general satisfaction for that purpose, I have decided to show some patterns dyed by it in Cotton Section.

It has also been applied to the dyeing of wool in almost all colors, but as all colors can be dyed on wool perhaps brighter,

cheaper, and quicker, there would not be much advantage in presenting the same in this book, especially as all particulars can be obtained from the agents for it. I therefore have confined myself to the Turkey red and blue shades on cotton produced by it.

No. 4.—*A New Substitute for Indigo.*

A German patent has been issued for the preparation of blue and violet colors which, according to the *Chemical Review*, are distinguished by great fastness and cheapness, the nitroso derivatives of the tertiary aromatic amines or phenoles on the so-called chlorequinommedes form coloring matters. If they are mixed for a long time with alkaline or ammoniacal solutions of phenoles the formation can be effected at once if the reaction is set up with the addition of reducing agents such as zinc powder or protoxide of tin (stannous oxide). The patentees have worked chiefly with nitrosodimethylaniline and nitrosophenol. The principal phenoles used have been common phenol, resorcine, orcine, and the naphtholes. One of the patentees had previously mentioned quite different colors which are formed from nitrosodimethylaniline and the phenoles, and are produced in acetic acid solution at boiling heat, whilst the new colors are formed in a new alkaline solution and at the common temperature. As an instance of the preparation of the new colors we may take the receipt for obtaining a blue from a naphthol and amidodimethylanile. The latter substance is prepared by the reduction of nitrosodimethylaniline in 100 gallons of water, is reduced by adding 10 pounds of the best zinc powder, and heating from 113° to 122° F.; the solution is separated by filtration from the excess of zinc and from the zinc oxide which has been formed and mixed with the following solution:—

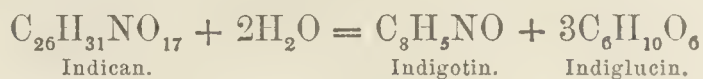
A naphthol	12 lbs.
Soda lye (caustic) at 60° Tw.	12 “
Bichromate of potash	10 “
Water	20 galls.

When the two liquids have been properly mixed common acetic acid is slowly added. The coloring matter is produced at once, and is completely precipitated as soon as the liquid, which was

alkaline, has become slightly acid. The whole is then filtered, the adhering mother liquor is removed by washing with water, and the product is ready for sale and use either as a paste or as powder. Violet colors are obtained in a similar manner from b. naphthol and resorcine, or the colors may be produced at once upon the fibre. The price of the color is scarcely half that of indigo, the tinctorial power high, and the fastness satisfactory, hence it has a much better prospect of competing with indigo than has nitropropedic acid.

No. 5.—*Indigo and its Artificial Production.*

Concerning the origin of indigo in the leaves of the *Indigofera*, various and contradictory views have been held. Some have supposed that blue indigo exists ready formed in the plant; others, that white indigo is present, which on exposure to air is converted into *indigo-blue*. Schunck has, however, proved beyond doubt, that the woad plant (*Isatis tinctoria*), the *Indigofera tinctoria* of India, and the Chinese and Japanese indigo plant (*Polygonum tinctorium*) contain neither indigo-blue nor white indigo ready formed. It is now known that by careful treatment the leaves of all these indigo yielding plants can be shown to contain a colorless principle termed *indican*, and that this easily decomposes, yielding a sugar-like body and indigo-blue. That white indigo is not present in the leaves is proved by the fact that this compound requires an alkali to be present in order to bring it into solution, whereas the sap of the plants is always acid. The decomposition is represented by Schunck as follows:—



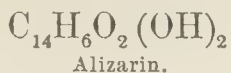
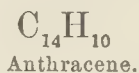
So readily does this change from indican to indigo take place, that bruising the leaf or exposing it to great cold is sufficient to produce a blue stain. Even after mere immersion in cold alcohol or ether, when the chlorophyll has been removed, the leaves appear blue, and this has been taken to show the pre-existence of indigo in the plant. But these appearances are deceptive, for Schunck has proved that if boiling alcohol or ether be used, the whole of the color-producing body as well as the chlorophyll is

removed, the leaves retaining only a faint yellow tinge, whilst the alcoholic extract contains no indigo-blue, but on adding an acid to this liquid the indican is decomposed and indigo-blue is formed.

Indigo is the second natural coloring matter which has been artificially prepared; alizarin, the coloring matter of the madder-root, being the first. As a rule the simpler problems of synthetic chemistry are those to which solutions are the soonest found, and these instances form no exception to the rule. The synthetic production of indigo is a more difficult matter than the artificial formation of alizarin, and hence no apology is needed for leading up to the complex through the more simple phenomenon.

When the ingenious Japanese workman who had never seen a watch had one given to him with an order to make a duplicate, he took the only sensible course open to him, and carefully pulled the watch to pieces, to see how the various parts were connected together. Having once ascertained this, his task was a comparatively easy one, for he then had only to make the separate parts, and fit the real article so that no one could tell the difference. So it is with the chemist, until he knows how the compound is built up, that is, until he has ascertained its constitution, any attempt at synthesis is more like groping in the dark than like shaping the course by well-known landmarks into harbor.

In the case of alizarin it was comparatively easy to reduce it to its simplest terms, and to show that the backbone of this coloring matter is anthracene, $C_{14}H_{10}$, a hydro-carbon found in coal-tar. This fact being ascertained, the next step was the further process of clothing the hydro-carbon by adding four atoms of oxygen and



subtracting the two atoms of hydrogen present in excess, and this was soon successfully accomplished, so that now, as we know, artificial alizarin has excluded the natural coloring matter altogether.

No. 6.—*Blue Dye.*

Schutzeuber and Naudin, Paris, say they can produce a dark blue on cotton equal to indigo. If an aniline salt be oxidized on a cotton stuff, it becomes dark green; this green, reduced by hydro-

sulphuret and hypostannate of potassa, and reoxidized by potassa bichromate and ferric chloride, generates a fast dark blue.

No. 7.—*Compound Indigo Blue Dye.*

The compound indigo blue dye prepared under letters patent numbered 150,427. was granted to Gustav Mott, of Millbury, Mass., dated May 3, 1875, of which Whitney and Mott are sole proprietors. The dye is prepared under the supervision of Mr. Mott the patentee, and can be procured only of Whitney and Mott, and their agents. With this dye they guarantee a better color, more of it with less expense than with a woad or ash vat, and no possibility of losing a vat, as frequently occurred by the old method. With it they produce the deepest navy blue as easily as the lightest shades. They produce from one vat in the same day all shades of blue from the deepest navy to the merest tint. It is the only process by which very light drabs, lavenders, and all other shades for fancy cassimeres and doeskins can be obtained in fast colors. Five to ten per cent. of the indigo lost in scouring by the woad and ash vat process is saved by the use of this dye. There is no sediment, the process is perfectly simple, any dyer can learn in half a day and make from ten to forty dips per day depending on the shades required. With one vat as much wool or cotton can be colored by this process as with five by the woad or ash vat process, giving fast colors in all cases.

It will stand any test for indigo by the old process, especially is it desirable for wool and cotton yarns in light and medium shades for small mills that have not been able to support a woad vat depending on woods and chemicals for a very poor blue.

By this process a fast blue can be produced with less trouble than by any other, whether they produce a fast or fugitive color. The compound indigo blue dye has now been used for two years giving satisfactory results in all cases, wood vats or tubs, copper or iron kettles can be used, any size will answer; as there is no sediment, the compound indigo-blue dye is put up (in solution) in barrels weighing about 400 pounds net, marked X and XX. The above is an extract from their circular.

No. 8.—*Artificial Indigo, Dr. Baeyer's.*

Dr. Baeyer, of Munich, has taken out two patents for his processes. Here is a condensed outline:—

The preparation of artificial indigo is based upon the transformations of cinnamic acid and analogous bodies.

Cinnamic acid is found naturally in the balsams of Tolu and Peru, in storax, benzoin, and other analogous resins.

Old essence of cinnamon often deposits crystals of cinnamic acid, it being produced in this case by the oxidation of hydride of cinnamyle.

Liquid storax is distilled with five or six times its weight of water. Styrol distils over and condenses in the receiver along with water. The residue is repeatedly treated with carbonate of soda, which removes the cinnamic acid. The resinoid matter remaining after the washings is spongy, and retains in its interstices a yellow oil—styracine.

The solutions of cinnamic acid in the carbonate of soda are concentrated and decomposed with an excess of muriatic acid.

Impure cinnamic acid is deposited in the liquid in the form of an oil which solidifies on cooling. Crystals of cinnamic acid are formed at the same time. The crystals and the solidified matter are collected, washed with a little cold water, and dried, and distilled, when at once cinnamic acid passes over almost pure.

The last products are contaminated with empyreumatic oil. To purify them they are dissolved in boiling water, and filtered on a platinum filter (the funnel is double, and in the intervals boiling water or steam circulates to prevent the liquor from cooling). The oil remains upon the filter, and the filtrate gives pure crystals of cinnamic acid.

The proprietors of Baeyer's Patent, the Baden Aniline Co., have taken out a new patent for the manufacture of cinnamic acid, from chlorinized benzoic aldehyde. Benzoic acid then serves for the production of cinnamic acid, the latter plan producing equally good results at much less trouble and cost. Benzoic acid is made from hippuric acid, a product of cow's urine.

In the presence of this invention it looks as though our old and valued servant, Mr. Indigo, had received notice to quit.

No. 9.—*A New Method of Dyeing and Printing by means of Indigo.*

By reason of its insolubility alike in neutral and in alkaline solvents the coloring matter of indigo cannot be fixed upon any textile fibre until it has been reduced, *i. e.*, converted into white indigo which is soluble in alkalies and solutions of the alkaline earths. The energetic reducing properties of hydrosulphate of soda, and its almost instantaneous action upon indigo, which it converts into white indigo in presence of an alkaline solution even at ordinary temperatures, have induced Messrs. Shutzenberger & Halande to examine the practical employment of this salt in the various applications of indigo in the arts of dyeing and printing.

The indigo vats most generally used in modern times are the sulphate (green copperas) vat for vegetable fibres, and the fermenting vat for wool dyeing. The main defect of the copperas vat is the presence of a bulky sediment of oxide of iron and sulphate of lime, which requires to subside before the clear portion of the liquid can be used for dyeing. The fermentation vat is difficult to work, and is subject to accidents or morbid changes which sometimes in the course of a few hours involve the entire loss of the indigo which they contain (such accidents are not unfrequently due to the malice of some workman, and are of course a kind of rattening).

The hydrosulphate vat which the authors propose in lieu of the present methods both for animal and vegetable fibres, set as follows: Bisulphate of soda marking 30° to 35° Beaumé (1.26 to 1.36 specific gravity) is put in a covered cask filled up to the surface with coils of sheet zinc or granulated zinc. This arrangement serves to increase the points of contact between the liquid and the metal. After standing for about an hour the liquid is drawn off into milk of lime, which precipitates the salts of zinc. The whole is well stirred, and the clear liquid is separated either by filtration and pressure or by decantation, water having been previously added. During all these operations air should be as far as possible excluded. If the hydrosulphate of soda thus obtained is mixed with ground indigo and the amount of lime or soda needful to dissolve the reduced indigo, we immediately ob-

tain a yellowish solution which contains no insoluble matter except the earthy matters present in the indigo. By this process 1 kilo. (2.2 lbs.) of indigo may be reduced and dissolved in such a concentrated state that the liquid does not exceed 10 to 15 litres (2.64 to 3.96 gals.). In dyeing, the beck is filled with water, a suitable amount of reduced indigo added, and the operation is performed in cold for cotton and at hand-heat for wool. The dye-liquid being clear for its entire depth, the dyeing process can be conducted without loss of time. The excess of hydrosulphate present constantly reduces the scum of oxidized indigo which forms on the surface of the bath, and successive quantities of the concentrated solution of indigo are added from time to time as they are required. By means of this facility of keeping the vat at any degree of strength required, any shade may be produced with the least possible time and trouble. As regards cotton dyeing, the new process is distinguished for its ease and rapidity. In wool dyeing all risk of spoiling the indigo is avoided. Shades are produced at once brighter and more solid than with the old vats, and it is easy to obtain on wool bright blue bottoms, such as were formerly only producible by means of the sulphate of indigo, and which were of course much more fugitive.

In printing with indigo the process hitherto followed has been to use white indigo or indigotate of tin obtained by precipitating a tin vat with hydrochloric acid, or by adding to the clear portion of a copperas vat a mixture of hydrochloric acid of tin. This precipitate is thickened with gum, and printed on calico. It is then fixed by treatment with milk of lime; the goods are then successively passed through bleaching liquor, sulphuric acid, and a soap bath. The process is at once difficult, delicate, and expensive. It is only by constant and anxious attention that running and injuries to the accuracy of the design are avoided during the treatment with lime-water, and only a very small fraction of the indigo is actually deposited upon the fibre.

The numerous attempts hitherto made to replace the above-described process by some other means of indigo, have not proved successful. We need only mention as instances China blue, pencil blue, and printing with a concentrated indigo vat in an atmosphere of coal gas in order to exclude atmospheric oxygen. The new

method (as tested by the authors upon a manufacturing scale) consists mainly in printing with an alkaline solution of dissolved indigo, suitably concentrated and thickened, the color containing moreover a large excess of hydrosulphate of soda. The presence of this salt keeps the indigo blue constantly in a perfectly reduced state, which would otherwise become oxidized. It thus supersedes in a much more convenient manner the use of coal gas; the printing can be carried on in common air with ordinary machines; oxidation is so little perceived that after an hour of working the color remains reduced to yellow. On the other hand, by printing on dissolved indigo immediate fixation is secured, as the coloring matter is almost entirely utilized.

Experience shows that with shade of equal depth solid blues are obtained at an expenditure of 50 to 60 per cent. less indigo than with the old process; the shades obtained are more beautiful and solid, and the design comes out more distinct and better defined. The new blue, not needing to be fixed by any subsequent process after printing, can be applied simultaneously with the majority of other colors, such as aniline black, garaneine colors whether obtained by dyeing or steaming, catechu, chrome colors, albumen colors, etc. Novel styles can be thus originated, which can scarcely be executed by any other process. The new color is obtained by thickening with gum or any other suitable substance, an alkaline solution of white indigo sufficiently concentrated, and adding to the mixture a sufficient quantity of hydrosulphite of soda. After the printing the indigo is oxidized by hanging up the pieces for twelve to fourteen hours. They are finally washed and soaped.

I find an application for a patent (3407) for the same thing, or certain hydrosulphates, by Messrs. Holliday. Is it a new thing? or only the old thing with hydro put to it? The effects of hydrogen upon indigo by means of zinc are well known, and have been worked out at some length with the alkalies and alkaline earths, and very dense solutions prepared and cotton and woollen dyed with it. If zinc be added to a solution of indigo it deoxidizes, and cloth dyed with it is very fast (see Muspratt, vol. i. page 593). Is not this an hydro? when hydrogen displaces oxygen and for sulphites and sulphides alkalies, etc. (see Muspratt, vol. i. page 592; see, also, Gregory's Handbook of Organic Chemistry, fourth

edition, page 362, not to name Crum, Hofmann, and others). I applied to the firm for information as to the mode of applying their process to the dyeing of various fabrics, such as might be recommended by themselves, thinking it would benefit the trade generally and also the firm as the venders of the patent article. The following, however, is the answer sent me: "We are not in a position to give you any particulars of our indigo process just now to put in your book." I have, therefore, given what information I could independently, and trust it may be none the less useful.

FURTHER REMARKS ON ZINC BLUE.

Dissolve bisulphate of soda at 30° B. with granulated zinc for an hour in a closed box, as air must be excluded the agitator should play through a stuffing box; then draw off and mix with milk of lime, so as to precipitate all the zinc in solution. To the clear liquid add finely ground indigo and a sufficient quantity of lime or soda to dissolve the white indigo formed. Cotton is dyed cold as in the old process; 1 lb. of indigo to 1½ gal. of the solution makes a strong vat.

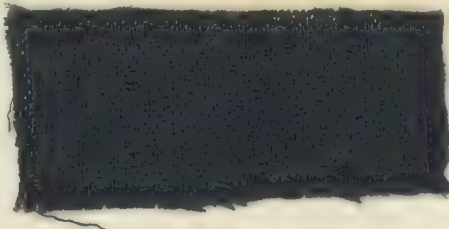
SECTION VIII.
DYEING DRESS GOODS.

No. 1.—*Light Green.*

Prepare with tannin; then tin; wash, and dye to shade with aniline green. For yellower shades add a little turmeric.

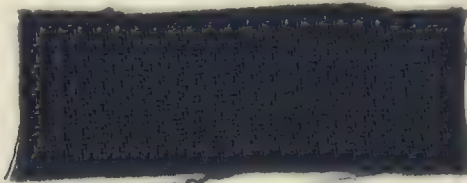
No. 2.—*Dark Green.*

Mordant; then iron; wash well. Dye with aniline green to shade.



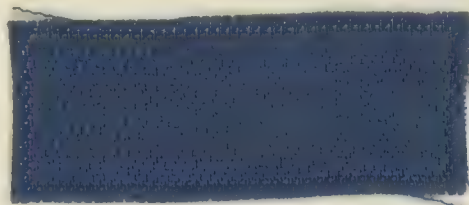
No. 3.—*Darker Green.*

Mordant, and iron as last, and when washed run through log wood liquor, the strength of which is regulated according to the depth of color required. It is then topped off in the same bath with malachite green to shade.

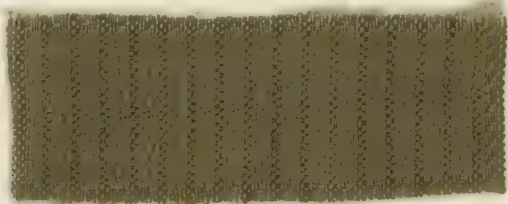


No. 4.—*Peacock*.

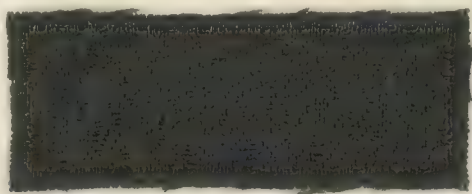
Prepare with tannin. Dye with 12 per cent. green, 1 per cent. violet 5 B. For darker shades run through iron liquor, and wash off before dyeing.

No. 5.—*Bronze*.

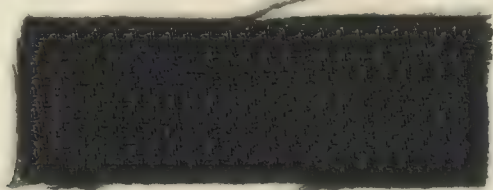
Prepare with tannin. Dye with 5 per cent. Bismark, 1 per cent. aniline green and turmeric to shade.

No. 6.—*Olive*.

Prepare with tannin. Then run through iron liquor; wash off. Dye with equal parts of Bismark and aniline green; turmeric may be used for enlivening or logwood to darken.

No. 7.—*Dark Bronze*.

Same as No. 6, only use half the quantity of Bismark and more turmeric and logwood.



No. 8.—*Darker Bronze.*

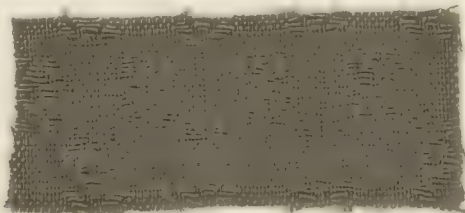
Same as No. 6, with a little logwood in the dye-kettle after it is washed from the iron liquor, and before the aniline is added.



By varying the proportions from the above all shades can be obtained; or, see Mixed Yarns.

No. 9.—*Gray on Cotton or Mixed Goods.*

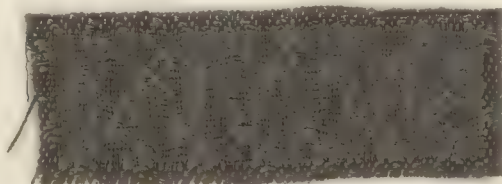
To dye cotton or cotton and wool mixed (100 lbs.) use 3 lbs. of aniline mordant dissolved in boiling water. Handle the goods in this for ten or fifteen minutes at hand heat; pass through sulphate of iron (see mordants), rinse, and finish. Any shade may be obtained in this way from silver to slate on cotton. If on mixed goods use the same quantity of aniline mordant, but bring up from 100° F. to the boil before saddening; the wool and cotton will then take alike.

No. 10.—*Drab.*

The new way to dye cotton or cotton and wool mixed: mordant as for gray (No. 9), dye in peach wood, and fustic.

No. 11.—*Dark Gray.*

On cotton and mixed goods same as gray (No. 9), and repeat; top off with blue to shade, or for redder shades with blue and violet.



No. 12.—*Drab*.

First wool dye with 15 lbs. Glauber's salt, 3 pints oil of vitriol, 2 lbs. cudbear, 3 gills extract of indigo; boil three-quarters of an hour, then cotton dye by running through sumac and iron, and afterwards through a weak vitriol bath. Darker and lighter shades can be made by varying the amount of dye stuff.

No. 13.—*Fawn Drab*.

To a bath of warm water add the solution of half a pound of anatto previously dissolved with four ounces of pearl ash, $1\frac{1}{2}$ lbs. sumac, 1 lb. fustic; enter silk, work half an hour, and darken with 1 lb. of copperas.

No. 14.—*Dark Fawn Drab*.

Wool dye with 12 lbs. of Glauber's salt, 3 pints oil of vitriol, 3 ozs. cudbear, 1 oz. sulphate of indigo, 3 ozs. archil; boil one hour, and then wash off, and cotton dye with sumac and iron, and afterwards enter a weak bath of vitriol to clear the worsted and brighten the cotton. Care should be taken not to have the vitriol bath too strong, as it will strip the colors.

No. 15.—*Lavender Drab*.

Wool dye with 1 pint extract of indigo, 2 ozs. cudbear, 10 lbs. Glauber's salt, 1 pint oil of vitriol. Dye the cotton by sumac and spirits; wash off, and finish with small quantity of purple.

No. 16.—*Yellow Drab*.

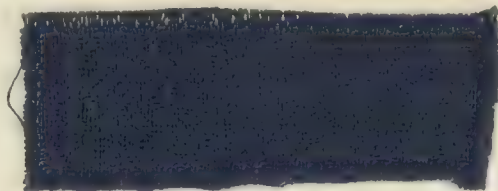
Dissolve 1 lb. anatto, 10 ozs. pearl-ash; add to the solution 2 lbs. scalded fustic, 10 ozs. extract of sumac; enter; keep in motion for three-quarters of an hour, and take out, and add to the same bath the solution of $\frac{1}{2}$ lb. copperas, 6 ozs. argol; enter again, work half an hour, and wash off.

No. 17.—*Heavy Dark Drab*.

Dye in a killed liquor with 2 lbs. fustic, 4 ozs. extract of indigo, and a small quantity of logwood.

No. 18.—*Blue Slate.*

Prepare with tannin. Then iron; wash off, and top with about 8 per cent. green, 1 per cent. violet.



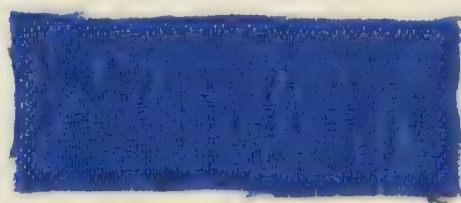
Any dark shade can be obtained by varying the green and violet.

No. 19.—*Blue, very light, for Cotton and Wool Mixed.*

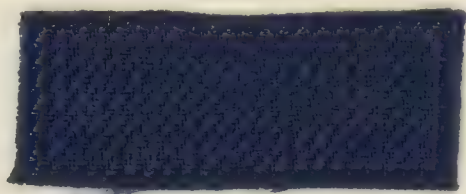
To dye cotton, or cotton and wool mixed, 1 lb. of aniline mordant dissolved in boiling water; handle the goods in this for ten or fifteen minutes at hand heat; pass through the usual quantity of well-killed tin; let it lie in alkaline blue, either cold or hand heat, until the desired shade is obtained. If mixtures of wool, dye the wool first.

No. 20.—*Blue for Cotton and Wool Mixed Goods.*

To dye cotton, or cotton and wool mixed (100 lbs.), use 3 lbs. aniline mordant, as No. 19, then run through muriate of tin; dye to shade with pure blue or cotton blue; not to be rinsed from this. If mixed goods, commence at 100° F. and gradually raise to 200° F.

No. 21.—*Blue, Darker Shades, Mixed Goods.*

Mordant same as last; raise gradually till wool and cotton are a match; do not wash, but fix in weak starch, same as No. 20, but pass through logwood liquor before the blue.



Note.—As these two blues are dyed strong, the liquor may be kept for further use.

No. 22.—*Aniline Blue on Woollen Mixed Clothing.*

Immerse into a filtered decoction of 1 kilo. sumac (2.2 lbs.) after having dissolved therein 125 gr. (4.3 ozs.) castile soap, leave it there for a night, take it out again, introduce it for six hours into a bath of acetate of alumina of 2° B. ; dissolve the aniline blue of a greenish cast in boiling water, let it cool, filter, and prepare a bath for dyeing, to which there is added one-tenth of the acetate of alumina bath; begin cold, and then gradually raise the temperature to the boiling point, the dyeing being finished in this boiling bath. Wring and wash; pass through a gum-tragacanth solution, and dress on the cylinder.

No. 23.—*Sky Blue* (100 lbs.).

First wool dye with 1 quart extract of indigo, 10 lbs. Glauber's salt, 1 quart oil of vitriol; wash, and cotton dye as follows: Enter bath of nitrate of iron 2° Tw.; wash, and enter another bath containing 2 lbs. prussiate, 1 pint of vitriol, and wash off.

No. 24.—*Dark Aniline Blue* (100 lbs.).

First wool dye with $\frac{1}{2}$ lb. of serge blue and 1 quart oil of vitriol; boil one hour; wash off, and dye cotton by sumac and iron; wash, and enter in a weak solution of logwood.

No. 25.—*Navy Blue* (100 lbs.).

First sumac and spirit, and dye off at a boil with 8 ozs. of aniline navy blue, $\frac{1}{2}$ pint oil of vitriol. Darker shades can be made by adding more aniline and vitriol to the bath. Fill up the cotton with cold logwood.

No. 26.—*One Dip Blue.*

For 100 lbs. light shade dissolve 4 ozs. Bird's aniline cotton blue, and add 2 quarts of special liquor mordant; commence cold and raise very slowly to the boil. Dark shades require 1 lb. of color.

Cotton and wool will match and require no washing.

No. 27.—*Victoria Blue.*

This new color will be found very useful, as it is adapted for all animal or vegetable fibres, producing full shades, as light as No. 20 or as dark as No. 21. On mixed goods prepare with 2 lbs. of aniline mordant, as No. 19, for $\frac{1}{2}$ hour, then pass through a tin liquor from which well wash.

2d bath—add the dissolved color to shade, commence at 150 F. and gradually raise to the boil.

Victoria Blue can be procured on the green, blue, or red shades, they are most suited for full and dark colors. When for the latter, after the mordant, they should be run through iron liquor in place of the tin, and for very dark colors logwood can be given to finish to shade.

No. 28.—*Eosine on Mixed Goods.*

1st. Prepare the wool with alum.

2d. Then mordant as for cotton.

3d. Dye at hand heat.

No. 29.—*Pink.*

The new and simple way to dye cotton or cotton and wool mixed (100 lbs.).

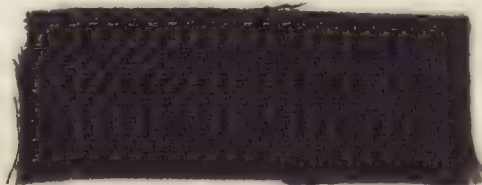
Take $1\frac{1}{2}$ lbs. aniline mordant dissolved in boiling water; handle the goods in this for ten or fifteen minutes at 100° F.; then dye in hand heat magenta bath. Use the dye very sparingly to prevent the shade being too dark. Cotton and wool will be alike if not dyed too hot. Saffronine can be used in place of magenta if preferred.

No. 30.—*Magenta on Cotton or Mixed Goods.*

Mordant with 2 lbs. same as No. 29, only use strong magenta bath, according to pattern; from 100° F. bring to a boil.

No. 31.—*Claret on Cotton or Mixed Goods.*

Prepare with 2 lbs. of mordant same as pink No. 29, only after mordanting run through iron liquor; well rinse in two or three waters either warm or cold, and dye in magenta bath. The iron liquor makes the difference between magenta and claret.



No. 32.—*Maroon for Cotton or Mixed Goods.*

Same as pink, only use stronger mordant and magenta bath, according to pattern; heat about 100° F. to start, and gradually raise the heat when the cotton has taken full enough.

No. 33.—*Maroon.*

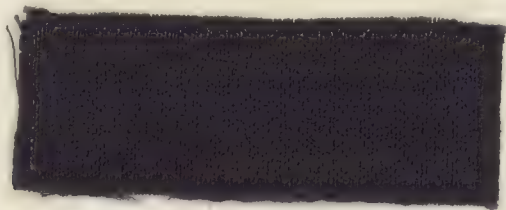
First sumac, and spirit, and dye off both together with magenta to the shade required; for darker shades use logwood.

No. 34.—*Claret Color (100 lbs.).*

First sumac, iron, and spirit; wash, and dye off with 6 ozs. of magenta, 2 lbs. logwood, 2 ozs. picric acid.

No. 35.—*Another Way.*

First dye the worsted with 1½ lbs. magenta, then sumac, iron, spirit, and dye off with ¾ lb. magenta, 2 lbs. logwood.

No. 36.—*Aniline Scarlet (100 lbs.).*

First sumac and spirit the cotton, and dye the cotton red with aniline cotton scarlet; then dye off with 1 lb. eosine and 1 pint acetic acid at a boil.



No. 37.—*Crimson* (100 lbs.).

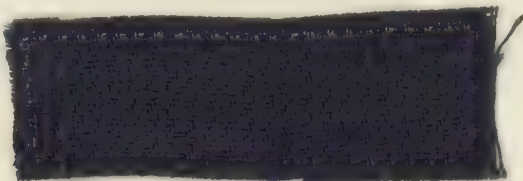
First dye the worsted with 2 lbs. cochineal, 3 pints muriate of tin, 2 lbs. red tartar; they are then washed, and the cotton dyed same as cardinal.

No. 38.—*Aniline Cardinal* (on 100 lbs. of stockings).

The wool is dyed with $1\frac{1}{2}$ lbs. aniline scarlet, 1 pint vitriol; enter, cool, and work slowly to a boil, and boil twenty-five minutes; they are then washed, and the cotton is dyed as follows: enter in sumac and spirit bath, and afterwards finish with peachwood and a little muriate of tin.

No. 39.—*Prune*.

Mordant, then iron; wash off; run through logwood, then in same bath top with violet.

No. 40.—*Plum*.

Same as prune, only use 3 per cent. violet and 1 per cent. Bismark, or for redder shades magenta for topping off.

No. 41.—*Pansy on Woollen Mixed Clothing*.

For 100 kilos. (220 lbs.). Make a decoction of 2 kilos. (4.4 lbs.) sumac, filter, and dissolve $\frac{1}{4}$ kilo. (0.55 lb.) castile soap, put the cloth into it, and leave it there for a night; wring the next morning, and enter into a new methyl violet bath according to the cast to be obtained, heating the same gradually to the boiling point;

leave it to get cool in this bath ; press it ; pass it through a gum-tragacanth solution, and finally dress on the cylinder.

Methyl violet and dahlia (soluble in water) are dyed on silk in a soap bath, on wool direct, and on cotton with tannin and tartar emetic.

No. 42.—*Violet on Cotton or Mixed Goods (100 lbs.).*

Use 2 lbs. aniline, as No. 19 ; mordant at 100° F., and handle in for five or fifteen minutes according to stoutness ; then lift and drain, and without rinsing, or the use of stannate or tin, dye to pattern ; start at 100° F. Thus wool and cotton are dyed at once.

No. 43.—*Brown, Light Shade, on Cotton or Mixed Goods.*

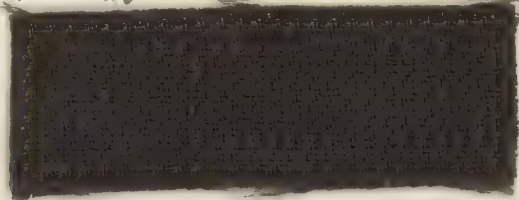
To dye cotton or cotton and wool mixed for 100 lbs. use 1½ lbs. aniline mordant dissolved in boiling water ; handle the goods in this for ten or fifteen minutes at hand heat. Dye in Bismark to shade.

No. 44.—*Brown, a Darker Shade, on Cotton or Mixed Goods.*

Mordant same as No. 19, only pass the goods through sulphate of iron, and rinse them before putting them in the Bismark dye bath.

No. 45.—*Brown, Dark Shade, on Cotton or Mixed Goods.*

Mordant same as No. 19 ; pass through the sulphate of iron, rinse ; repeat in mordant and sulphate of iron in order to obtain depth of color ; rinse, and dye in Bird's dark aniline brown.



No. 46.—*Brown, very Dark, on Cotton or Mixed Goods.*

Same as No. 19, only pass through logwood liquor before dyeing in the Bismark ; tinge with green. Ordinary nitrate of iron, or black iron liquor will answer for all three shades.



No. 47.—*Chestnut Brown on Dresses with Cotton Warp.*

For 5 kilos. (11 lbs.) of tissue. A decoction is made of 1 kilo. (2.2 lbs.) cutch in water, which is drawn off, and there is then added a solution of 150 gr. (5.25 ozs.) blue vitriol. Into this clarified bath the dress is steeped, well spread out, and it is left to stay there for an hour; it is then removed, wrung, and put into a boiling bath containing 500 gr. (17.5 ozs.) tartar and 300 gr. (10.5 ozs.) bichromate of potassa. Let this boil for half an hour, then take it out, and dye over again with 1 kilo. (2.2 lbs.) Lima-wood and 500 gr. (17.5 ozs.) turmeric. After boiling it for half an hour, it is then lifted out and examined whether the precise cast wanted has been obtained; if not, the exact shade can easily be had by adding either a little Lima-wood, fustic, or logwood, taking care to keep up the boiling point. Should the cotton warp differ in color from the body of the dress, it will be necessary to add to the dyeing bath 100 to 150 gr. (3.5 to 5.25 ozs.) alum; the cloth is immersed once more, but the bath is not made to boil. The precise tint will then be uniform, and all that can be wished for.

No. 48.—*Cutch Brown on Dress Goods, Mixed Cotton, and Wool.*

Cutch brown, new way for job dyers.

Dissolve about 20 lbs. cutch in boiling water, then add 8 ozs. bluestone. This will be found strong enough as a stock liquor to dye six or eight dresses in for six times with only the adding of 3 ozs. of bluestone each time, and then will do again by replenishing with cutch.

To dye, put the dresses with most cotton in first, and so on until they are all in, taking care that the heat is gradually rising all the time, but they need not boil. Keep them in about one hour; lift them out, and cool; and while this is doing, a second vessel of scalding water should be got ready, into which put 3 ozs. chrome; the dresses, without rinsing, will pass through this in the same order as before for ten minutes each. Then lift, and wash, and in a third vessel have at good hand heat a Bismark liquor ready to top them off in. About 2 ozs. of Bismark carefully dissolved will do for eight dresses. Put in about 1 oz. first,

and add as you go on. Do one dress at a time; this will make good colors and stand well.

No. 49.—*Brown on Dresses with Cotton Warp.*

For 25 dresses. 10 kilos. (22 lbs.). After the dresses shall have been thoroughly washed they are mordanted for two hours with bichromate of potassa; 100 gr. (3.5 ozs.) sulphuric acid and 80 gr. (2.8 ozs.) blue vitriol are then added, the dresses removed, aired, and washed. Into a tolerably large tub a decoction of 1 kilo. (2.2 lbs.), 250 gr. (8.75 ozs.) brown cutch is put, and 100 gr. (3.5 ozs.) blue vitriol are added thereto. The temperature of the bath should be 80° C. (176° F.). The dresses are introduced into this bath well spread out; they are then turned, and left to stay there for a night. The next day they are removed and transferred to a second tub well filled with warm water and 200 gr. (7 ozs.) bichromate of potassa.

No. 50.—*Chestnut Brown.*

First dye the wool with $\frac{3}{4}$ lb. of magenta, then sumac, iron spirit, and wash off, and dye off with $\frac{1}{2}$ lb. of magenta, $2\frac{1}{2}$ lbs. logwood, 8 ozs. picric acid at a boil, and wash off.

No. 51.—*Olive Brown.*

Dye the wool at boil with 5 pounds of turmeric, 2 gills of sulphate of indigo, 5 pounds of red tartar, 1 quart oil of vitriol; wash off, and dye cotton by, first sumac, iron, and spirit; wash off, and finish with 3 pounds of logwood, 10 pounds of peachwood, 10 pounds of turmeric, 3 pounds alum, 3 pounds blue vitriol; wash off, and they are finished. Darker or lighter shades can be made by varying the quantity of dyestuffs used.

No. 52.—*Bronze Brown.*

Proceed as with No. 51, only use much less of the ingredients, and peachwood, according to shade.

No. 53.—*Light Bronze.*

Proceed as with No. 51, only use no peachwood, and only part of the logwood to shade.

No. 54.—*Claret Brown.*

Proceed as with No. 50, only leave out the picric.

No. 55.—*Chocolate Brown.*

Proceed as with No. 50, only leave out the picric, and double or treble the amount of logwood as required.

No. 56.—*Tan.*

Mordant as with No. 43. Dye with 8 per cent. of Bismark and from 1 to 2 per cent. of green according to strength.

No. 57.—*Black on Mixed Goods.*

To dye cotton or cotton and wool mixed. If wool, dye this first, pass into a tub prepared with 4 parts of logwood and 1 of fustic, to which add 1 ounce of scalded aniline mordant for every 12 yards of stuff, or 1 pound of yarn. Let it lie in this liquor all night; lift, and sadden with 4 parts of copperas and 1 of bluestone or tar iron; rinse. If there should be any of them not on, repeat. In this way goods are both dyed and mordanted together, thus saving much time. Let fresh woods and mordant be added each time of using; dyeing lukewarm is preferable. If cotton pieces, they may be dyed hot in a much shorter time. They may be mordanted with double strength, washed, and, after running through iron liquor, dyed as if all wool.

No. 58.—*Bird's One-dip Black for Cotton and Mixed Goods.*

To start, use 3 parts of the weight of color as goods; add to it 3 per cent. of soda, and simmer or boil till black. For second bath, add three-fourths the weight of color to goods, but the same quantity of soda. In the next four baths, use respectively 50, 40, 30, and 20 parts of 100 of goods, and then keep at 20 pounds for all succeeding lots, with only the 3 per cent. of soda as before.

Old stock, all wool, or mixed will dye good black with about one-half the above proportions.

Excellent for faded blacks of wool, silk, cotton, or mixed.

No. 59.—*Black on Silk and Cotton Clothes.*

For 2 pounds. The goods are washed with soap, and in several hot waters afterwards, and put in a cold bath of nitrate of iron, 10° B. for one hour. Take out, rinse well, and work in a fresh cold bath of 8 ounces solid extract of quercitron bark for two hours. Rinse, and put in another bath of 1 pound logwood, 170° F. It is advisable to add to this bath 3 ounces quercitron. Rinse, and pass through a strong vinegar bath, and wash. For finishing, draw through a solution of 2 ounces gum Arabic in 20 pounds water, and dry on the cylinder.

No. 60.—*Black on Dresses with Cotton Warp.*

For 5 kilos. (11 lbs.). Prepare a bath with 5 kilos. (11 lbs.) logwood, and let it boil for three quarters of an hour; then prepare a fresh one with 150 gr. (5.25 oz.) blue vitriol and 250 gr. (8.75) sulphate of iron, place it again into the logwood bath after adding thereto 150 to 200 gr. (5.25 to 7 oz.) soda salt. Should the color not be dark enough, a little logwood decoction is added. Finally the darkening is completed by 80 to 100 gr. (2.8 to 3.5 oz.) green vitriol.



SECTION IX.

DYEING MIXED AND HOSIERY YARNS.

MIXED YARNS.

No. 1.—*Yellow.*

Dye with turmeric and raise in tin.

No. 2.—*Orange color.*

First dye the wool with $\frac{1}{2}$ pound aniline orange, 1 pint vitriol, wash, sumac, and spirit, then finish with 2 pounds phosphine.

No. 3.—*Yellow.*

The cotton is first sumaced and spirited, then dyed off both together with 7 ounces flavine, 2 pints muriate of tin at a boil, and wash off.

No. 4.—*Yellow.*

To dye cotton or cotton and wool mixed, prepare with 2 pounds aniline mordant dissolved in boiling water; handle the goods in this for ten or fifteen minutes at hand heat; dye in fustic liquor, and raise with alum or solution of tin. The alum may previously be added to the mordant.

No. 5.—*Orange.*

Give mordant and fustic as No. 4, and top off with orange.

For further information refer to yellow cotton dyeing, by which the cotton can be filled up after the wool has been dyed.

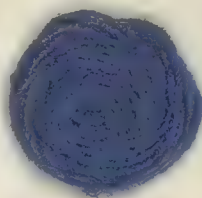
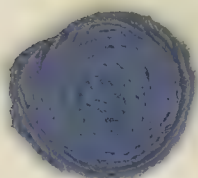
No. 6.—*Gray.*

Mordant with sumac; then run through tin liquor; wash off, and dye to depth in ingotine or induline.

For red shades work with or top off in 4 B. violet.

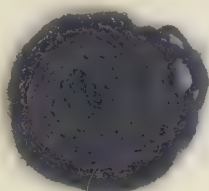
For bluer shades with cotton blue.

For greener shades with fustic.



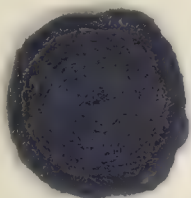
No. 7.—*Dark Gray.*

Dye as above with the addition of logwood.



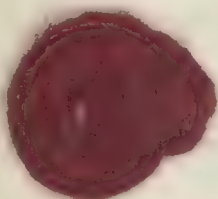
No. 8.—*Dark Peacock.*

Dye as for dark gray, but use a little green or fustic instead of violet.



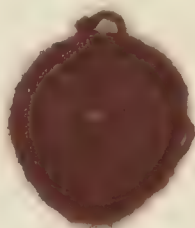
No. 9.—*B. Cardinal.*

Mordant with 20 pounds sumac ; run through tin liquor $2\frac{1}{2}^{\circ}$ B. ; well wash off. Dye with saffronine to shade.

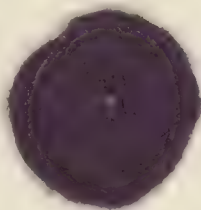


No. 10.—*R. Cardinal.*

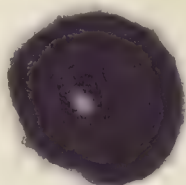
Same as last, with the addition of cotton orange or crysodine to shade.

No. 11.—*Claret.*

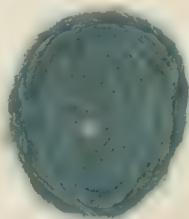
Prepare as for cardinal. Dye with 4 parts roseine and 1 part violet.

No. 12.—*Dark Claret.*

Same as last, only use 3 parts roseine and 1 part violet.

No. 13.—*Aniline Green on Mixed Goods.*

Use 1 pound mordant, and dye with green. If yellower shades are required after mordant, bottom in fustic raised with alum or tin. By this process any shade can be obtained in one dye on cotton and wool or silk mixed.

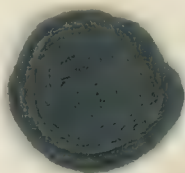


No. 14.—*Methyl Green upon Wool and Silk.*

When these mixed tissues are to be dyed with methyl or iodine, it is preferable to treat them separately before they are woven, in order to obtain a fabric as uniform as possible. If the wool and silk are already mixed, the operation of dyeing is more difficult. Methyl green adheres more easily to animal fibres than does iodine green. It is necessary to employ a very weak bath of tannin before the dyeing, and to use in the dye-bath a little ammonia and sal-ammoniac. Begin the dyeing at 70° F., and bring slowly to a boil. When finished, rinse the thread or cloth in water slightly acidulated with sulphuric acid at a temperature of 75° to 85° F. If a yellowish shade is desired it is then passed through a weak bath of picric acid.

No. 15.—*Aniline Dark Green.*

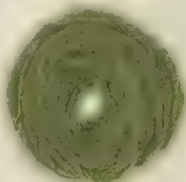
Mordant as No. 4, but instead of tin run through iron liquor; wash, then run through logwood, and dye in aniline.

No. 16.—*Dark Green from Aniline.*

First dye wool with 1 pound picric acid, 1 pound serge blue, 1 quart of vitriol; enter the goods, work at boil for one hour; wash off, and dye cotton as follows: Sumac and iron; wash off, and enter bath of logwood cold, with a little fustic and bluestone.

No. 17.—*Green Bronze.*

Mordant with tannin, then run through tin liquor; wash off, and dye with 2 parts green, 1 part Bismark; extract of fustic or turmeric may be added for yellower shades.



No. 18.—*Yellow Bronze.*

Mordant as last. Dye with 2 parts Bismark, 1 part green, and extract of fustic to shade.

For dark shade add to it Bismark and logwood, or violet in place of logwood.

It is best to dissolve them separately, and then add them to shade.

A practical man will get any shade, from a gold color to a bottle green, by varying the above, and giving iron liquors in place of tin to the dark colors.

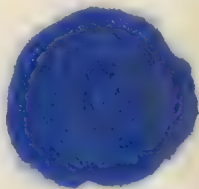
No. 19.—*Vat Blue for Wool, Silk, Cotton, and Mixed Goods.*

A small vat can thus be made: Have a strong barrel that will hold 10 or 12 gallons, and put into it 8 gallons of stale urine. Put into a stone jar 1 pound ground indigo and 3 pints pickling vinegar. Set the jar in a saucepan and let it boil one hour, stirring all the time; let it stand a day or two, then turn it into the barrel; rake up twice a day for a week. It will then be fit for use, and can be added to from time to time.

HOSIERY YARNS.

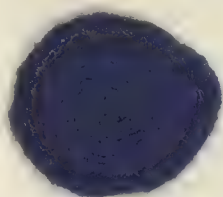
No. 20.—*Blue (100 lbs.).*

Dye with 1 pound cotton blue, 10 pounds alum, 5 pounds Glauber's salt; commence at 80° F., and bring slowly up to boil. The reason for commencing at a low temperature is to give the cotton a chance to take up as full as the wool.

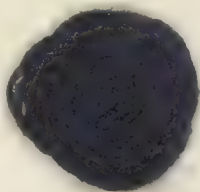


No. 21.—*Medium Blue.*

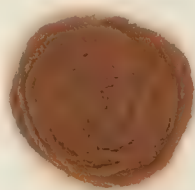
Proceed in the same way as last, with the addition of 6 B. violet to shade—preferably it should be topped off with the violet.

No. 22.—*Dark Blue.*

Prepare in 20 pounds sumac ; then run through cold iron liquor ; well wash off ; then run through logwood liquor 200° F. for a deep gray, and top off with 6 B. violet, or 4 B. in with a trifle of aniline green.

No. 23.—*Yellow Bismark.*

Lay down in sumac, then run through tin liquor ; wash off well, and dye with Bismark and fustic to shade.

No. 24.—*Brown.*

Prepare in sumac, then run through iron liquor ; wash well. Dye with Bismark, adding logwood and a little aniline green to shade.



SECTION X.

COTTON DYEING.

RAW COTTON OR COTTON-WOOL DYEING.

No. 1.—*Pink* (100 lbs.).

Prepare with 6 pounds sumac ; run through tin liquor at 2° Tw.; well wash off, and dye at 150° F., with from 3 to 4 ounces saffronine.



No. 2.—*Magenta* (100 lbs.).

Prepare with 10 pounds sumac, and run through tin liquor ; wash off well and dye with 8 ounces roseine.



No. 3.—*Brown* (100 lbs.).

Mordant with 10 pounds sumac. Dye with 2 pounds dark aniline brown (Bird's); for darker shades use 3 lbs. of color.



No. 4.—*Dark Seal Brown on Cotton-Wool* (100 lbs.).

1st bath: 20 pounds cutch, 20 pounds extract logwood, 5 pounds bluestone; let lay in all night. 2d bath: boil in 3 pounds of chrome; soften with $\frac{1}{4}$ bucket lard oil and 8 ounces sal soda. For darker shades use more logwood.

No. 5.—*Fast Red on Cotton with Alizarin* (22 lbs.).

Boil the yarn in soda lye at 4° Tw.; wash, and dry; then pass into a beck made of 24 ounces alizarin oil in 13 quarts of water at 122° F.; wring, and dry with heat.

Mordant with red liquor $10\frac{1}{2}$ pints at $8\frac{1}{4}^{\circ}$ Tw.; dry in heat, and age twenty-four hours.

Dung with 11 pounds cow dung and 2 pounds 3 ounces chalk in 44 pints of water at 150° F.; well wash, and wring.

Prepare a dye-bath as follows: 175 qts. Acetic acid 7 ounces, Turkey red oil $8\frac{1}{2}$ pounds; boil $9\frac{1}{2}$ pounds bran and add the liquor strained and red alizarin $27\frac{1}{2}$ ounces. Enter cold, and work one hour; then slowly raise to a boil in an hour and a quarter, and boil three-quarters of an hour; lift, and let drain till next day, then wash, wring, and dry. Work in a beck of 24 ounces Turkey oil at 95° F. with 13 quarts of water; wring, and steam one hour at one atmosphere.

Brighten in a closed vessel with $8\frac{3}{4}$ pounds soap, 2 pounds 3 ounces soda, 7 ounces crystals of tin. Wash, and dry in the air.

No. 6.—*Yellowish Scarlet on Cotton-Wool not fast* (40 lbs.).

Dissolve in clean soft water 4 pounds soft soap. Boil the cotton for half an hour, and transfer to a fresh water at 100° F., in which have been dissolved 6 pounds alum. Work for two hours, and then transfer to cold water with 5 pounds stannate of soda, and steep over night. Dye with 3 pounds "croceine scarlet.R." in a water at 100° F., with the addition of a little alum.

The flots may be preserved for further use, and will then require an addition of only two-thirds of the ware.

No. 7.—*Blue on Cotton-Wool.*

The mordant is made of 12 ounces of tannin, 1 ounce of tin salt, and 1 ounce of sulphate of copper, in which the articles (10 lbs.) are worked round for an hour or steeped. They are then placed in a hot bath containing 2 ounces of alkali blue in solution, left for an hour, taken out, allowed to drain, and put into a fresh cold bath with enough sulphuric acid to give it a distinctly acid taste. The tint is redder when the acid is added to the dye-bath and then washed.

No. 8.—*Logwood Blue on Cotton-Wool (220 lbs.).*

Mordant with sumac at a hand heat. The advantage of this process is not confined to blues, but it may be employed for other colors and for cloth of wool and cotton. The mordanting is done at from 86° to 104° F., the process being longer or shorter according to the strength or degree of concentration of the bath. Add to a water 17½ pounds acetate of soda, 6½ pounds bluestone, and 2 pounds 2 ounces alum. Dye in a fresh water with the decoction of 33 pounds logwood at a temperature of 160° F.

No. 9.—*Apple Green on Cotton-Wool (44 lbs.).*

Work first in red liquor at 9½° Tw., dry for forty-eight hours, rinse in running water, and dye at 140° F. with a decoction of bark and fustic.

To the same water is added

Extract of indigo 4½ lbs.

After the shade is obtained pass without rinsing into

Water 175 pints.

Extract of indigo 4½ lbs.

Dextrine 22 “

Dry, and finish with

Rice starch 8 lbs.

Water 87 pints.

Wheat starch 8¾ lbs.

Red liquor 11° Tw. 17½ pints.

Grease 20 ozs.

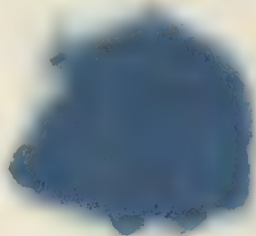
Dry in the air and calender.

No. 10.—*Fast Green on Cotton-Wool* (110 lbs.).

Boil out 22 pounds logwood; boil the cotton two hours, and let stand twelve hours; then drain; enter a cold bath of 22 ounces bluestone one-half hour; drain, wring, and return to the logwood bath, to which $1\frac{1}{4}$ lbs. soda have been added, with 5 ounces more bluestone and $3\frac{1}{4}$ ounces chrome; work half an hour; wash, and dye in a fresh beck at 150° F., in which 22 pounds of fustic have been boiled, and 12 ounces of soda added; boil one hour.

No. 11.—*Green on Cotton-Wool* (100 lbs.).

Prepare with 2 pounds Bird's aniline mordant. Then run through muriate of tin; wash, and dye with 8 ounces color.

No. 12.—*Green, Yellow Shade, on Cotton-Wool* (100 lbs.).

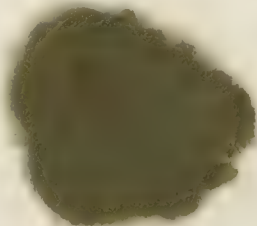
Prepare with 2 pounds aniline mordant, 1 pound alum, and 1 pound extract fustic. Let lay in half an hour, if yarn, if cotton-wool, two hours, to give it time to soak, and without washing. Dye to shade with malachite green.

No. 13.—*Methyl Aniline Green on Cotton-Wool* (50 lbs.).

Prepare with 5 pounds sumac, and afterwards take it into 4 pounds of alum, $2\frac{1}{2}$ pounds acetate of lead; then wring, and dye warm with the previously dissolved aniline green.

No. 14.—*Bronze.*

Equal parts of Bismark and green will take without mordant, but quicker and with less color if it is first sumaced and then run through tin liquor.



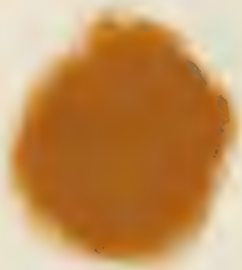
No. 15.—*Yellow* (100 lbs.).

Aniline mordant 2 pounds; scald it out, and add to it 2 pounds alum; work one hour.

Dye with extract fustic and a little cotton orange to redden it.

No. 16.—*Orange*.

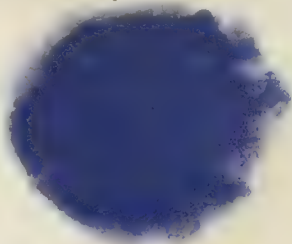
Dissolve cotton orange and add to it twice its weight of alum; dye at 150° F.

No. 17.—*Blue with Logwood*.

For 100 kilos. (220 lbs.). Boil the cotton for half an hour, and then work it in a tepid bath of 1½ kilos. (3.3 lbs.) blue vitriol, 1½ kilos. (3.3 lbs.) bichromate of potassa, and a decoction of 6 kilos. (13.2 lbs.) logwood, until uniformly colored; take it out, let it drip off, and beat. Prepare a fresh bath of a decoction of 20 kilos. (44 lbs.) logwood and 3 kilos. (6.6 lbs.) sulphate of soda, and dye the cotton in it till the bath is exhausted. Then prepare two baths: 1. Dissolve in water 2 kilos. (4.4 lbs.) nitrate of iron and 250 grams (8.75 ozs.) tin salt, work the cotton for half an hour in it, take it out and dry. 2. Dissolve in water 1 kilo. (2.2 lbs.) prussiate of potash and 1½ kilos. (3.3 lbs.) sulphate of soda, and work the cotton for half an hour in it, then wash. If the color is to be darker, stir the cotton repeatedly in these last two baths.

No. 18.—*Blue* (100 lbs.).

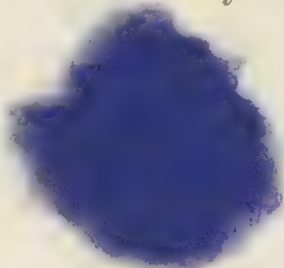
Mordant with tannin, then run through tin liquor; well wash off; dye with 1 lb. Victoria blue (Bird's).

No. 19.—*Silver Gray on Cotton-Wool for Fulling* (50 lbs.).

Boil in clear water, and enter in another water at 167° F., with logwood 3 pounds, tannin $4\frac{3}{8}$ ounces. Turn for an hour, lift, and add to the bath, black liquor $5\frac{1}{4}$ pints; re-enter, steep for half an hour, rinse, and dry.

No. 20.—*Methyl Violet on Cotton-Wool, Fast* (100 lbs.).

Steep the goods for two hours in the decoction of sumac 10 lbs. Enter in a second water of tartar emetic at $1\frac{3}{4}^{\circ}$ Tw. Wash well, and dye in a third water with methyl violet 11 ozs.

No. 21.—*Blue Violet on Loose Cotton to Stand Milling*
(100 lbs.).

Boil for one and a half hours in bath prepared with 5 pounds alum, 1 pound bichromate of potash, 2 pounds bluestone (sulphate of copper), $\frac{1}{2}$ lb. chloride (tin crystals). Leave for another hour in bath, then wring out. Next morning dye in hot bath with decoction of 75 pounds logwood. After three hours a solution of 2 pounds alum and $\frac{1}{2}$ pound sulphate of copper is sprinkled on; then, after one hour, it is washed, soaped, and dried. It is not necessary to boil the cotton before the mordant, but it is brought at once into the first bath.

DYEING CANTON FLANNEL.

No. 22.—*Scarlet.*

Mordant and tin in the usual way; then let it work for a short time in acetate of alumina (red liquor) 3° Tw.; then squeeze, and for 100 pounds dissolve about 4 pounds B. B. scarlet, and run at 120°, raising to 180° F. When full enough wring, and finish at once. It must not be washed. It will not smut. Much less dye will do next lots.

Nearly as bright color can be dyed by only running through red liquor. See Scarlet on Cotton Yarn.

No. 23.—*Magenta.*

Mordant and tin; well wash, and dye with about 8 ounces roseine 150° to 180° F.

No. 24.—*Blue.*

Prepare as for magenta, and wash. Dye with about 1 pound Victoria blue, more or less, to shade.

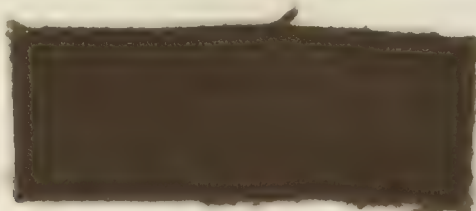
2d plan: Dye with cotton blue and from 5 to 10 per cent. alum, to which some add 2 to 3 per cent. of soda, and others Glauber's salt 10 pounds.

N. B.—The last is quite as bright, but not so fast as the Victoria.



No. 25.—*Brown.*

To 100 pounds, mordant with 2 pounds improved aniline mordant, and drain. Dye with 2 pounds dark aniline brown.



DYEING COTTON PIECE GOODS.

No. 26.—*Alizarin.*

Alizarin from the first must have possessed strong germs of life or it certainly would not have forced itself into so prominent a position in so short a time, especially when we take into consideration the proverbial conservatism of dyers in general.

Doubtless two circumstances favored it. First, the cost of Turkey red dyeing; and second, the fact that the only other fast red on cotton was camwood, or redwood, which would not nearly equal the tone of Turkey red. This left room for the introduction of a bright, fast red, which is admitted to be well supplied in alizarin.

I am fully aware that alizarin has been applied to the dyeing of wool fast colors, but with only one exception, namely, in its substitution for indigo blue, do I think there would be any real advantage in its adoption, all things considered, since the introduction of the new fast colors.

The process in blue I have therefore given in its proper place (Indigo Substitutes), and confine myself to that part of the invention for which its utility is of most importance, namely, reds, one of which will be found amongst cotton red dyeing. Here I give a sample of the best methods and the best oil mordant. Any other information can be obtained from the agents.

No. 27.—*Scarlet Shade.*

Preparation for red. 100 pounds of clean wool are mordanted with 24 pounds alum and 6 pounds gray tartar. Boil slowly for two hours; steep for twelve hours; lay aside for twenty-four hours.

Then take 8 pounds sumac, $\frac{1}{2}$ pound flavine, 2 pounds chalk. Boil for ten minutes; cool the liquor down to 100° F. Then add 8 pounds art. alizarin, W. Y. Enter the wool; raise the heat to a boil in one hour; boil for half an hour; let steep for two to four hours before drawing off the liquor.



No. 28.—*Blue Shade.*

Mordant as No. 27, and dye with 8 pounds sumac, 2 pounds chalk, 10 pounds art. alizarin, W. Y.



No. 29.—*For Darker Shade.*

Same proportion, using W. art. alizarin instead of W. Y.

No. 30.—*For yet Darker Shade.*

Same proportions, using W. B. art. alizarin instead of W. Y.

The defects which so often occur in this dyeing are to be imputed, not to the alizarin itself so much as to the thinness of the paste, and the presence of sulphuric acid from imperfect washings. Another serious cause is the rapidity with which the dyeing is performed. The color is absorbed too rapidly, and hence is poor and uneven. By employing tannin, after the aluming, a beautiful yellow is produced, but if too little tannin, and especially too little alum or nitrate of alumina is used, the color is bluish. Hence very great care is required in this part of the process, as slight errors in the mordanting show in the same manner, whether the fabric is dyed with madder, garancine or artificial alizarin. The chief defect in the mordanting is the use of too caustic soda, yield-

ing a pale, yellowish-red. If too small an amount of dung, or a poor quality of oil be employed, the color will be bluish. There should never be less than six paddings in oil, with not too short an exposure to moist and warm air between each. If this be neglected, the red is poor. If the goods are cleared in alkaline hypochlorites, as those of magnesia and tin, followed by oxidation in sulphuric and nitric acids, the red will be more fiery than when they are cleared in bleaching powder, followed by boiling in soap.

No. 31.—*A New Alizarin Oil Preparation.*

Chaudet, of Rouen, has introduced into commerce a new preparation, said to give better results than the emulsive oils and the sulpho-ricinates which are extensively used in the preparation of cotton yarns and tissues for Turkey reds, and also as a mordant for methylene blue, etc.

This new preparation, made, it appears, from castor oil, contains neither sulphuric acid nor soda, and is perfectly pure.

The sulpho-ricinates contain about 30 per cent. sulphuric acid, neutralized with an equal quantity of soda, and their composition is approximately castor oil 40 per cent., sulphuric acid, soda, and water 60 per cent. So that if 40 parts of emulsive oil are really wasted, 100 parts of the sulpho-ricinate are used.

The sulpho-ricinates are soluble, and do not absorb the oxygen of the air; they do not withstand rubbing, and are bled strongly on washing. The new emulsive oil is free from these defects; it becomes resinified in the air, and forms an insoluble and indestructible varnish.

No. 32.—*Turkey-red Dyeing with the New Oil.*

Prepare in the new oil, dry, and rinse. Mordant with red liquor (mixed with stannate of soda for roses and pinks), dry, take again through the oil bath, dye with alizarin, oil again, and steam. A smaller quantity of this new bath, say four-fifths, is needed than of the olive-oil bath.

No. 33.—*Examination of Turkey-red Oil.*

For determining the real amount of fatty acid in such samples Bruehl proposes the following process: He takes 50 parts by

weight of the oil in question and shakes up in a glass with 30 parts dilute sulphuric acid (1 part oil of vitriol in 10 parts of water). The sulphuricinoleic acid separated is then dissolved by adding 30 parts of ether, and the ethereal liquid is decanted off and allowed to evaporate. The weight of the residue after the ether has escaped gives the quantity of fatty acid, and if multiplied by two shows the percentage.

No. 34.—*Wool Scarlet or Azo Colors on Cotton.*

As these are the brightest colors known, it is very desirable to be able to use them on cotton. Much success has not as yet attended efforts in this direction, but as an incentive to further endeavors I will now give some of the most successful results, as far as I have become possessed of the facts.

In June, 1880, I found that by using equal parts of panceau (Lutz & Movius) of either shade, muriate of tin, and olive oil, when stirred up well together, then adding just sufficient water to pad or turn over the goods in at about 100° F., that 33 pounds of cotton would be turned out a fine scarlet, and that the result would be the same with orange, producing a fine orange.

They needed only to be wrung out of the color. The difficulty was to dry them evenly, as hot air or sun would make them run in parts, but in cold air it was successful. They did not smut much, the yarn was dyed quite through, and the color stands well, as I have some of it now, then dyed by me. But its drawback was—it would not bear washing.

It is now proposed to treat all the azo colors as follows: Steep the cleaned and bleached yarn, raw cotton, linen, or jute in 2 parts alum, 1 part sal soda, dissolved separately, and then mixed hot; as soon as settled, filter off the cleaner liquor, and make up a bath at 21° Tw. for six hours, then wring, and dye with 10 pounds color to 100 pounds goods at 140° F.: when to shade, wring up and dry; do not wash. Raw cotton, if preferred, can be laid down in stannate of soda at 14° Tw. for four hours, then wrung out, and to 10 parts color add 10 parts alum; handle for several hours at 140° F.

As the goods only take up one-third, or less of the color, a correspondingly less quantity is needed for next lots.

I have seen splendid shades obtained this way, but it is costly to start, and does not bear washing.

No. 35.—*Scarlet on Cotton.*

Mordant with bichloride of tin 4° Tw.; wash, then pass through red liquor 3° Tw.; wring out, and dye with 4 per cent. of wool scarlet.

No. 36.—*Dyeing Cotton with Wool Scarlet.*

Mordant in strong red liquor only, and dye with color to shade. This produces a good color, but not quite so bright as the following.

No. 37.—*Bright Scarlet to equal Wool.*

Pass the goods through a strong curd soap liquor, quite hot, for half an hour, then wring and dry in hot room. Then mordant with strong red liquor; dye with color to shade.

To save time and trouble, gelatine or glue may be added with the red liquor to save the soaping.

Note.—When tin is used on cotton, it should always be well washed out, or in time it will turn the goods to a dirty look. It is not necessary to wash from red liquor.

Note 2.—None of the above scarlets can be washed, as they would lose their color, but they do not smut, and bear light; therefore, for goods that have to be washed, cotton scarlet, or saffronine and crysodine, or for brighter shades, turmeric bottom and saffronine top are to be preferred. See Saffronine Scarlet.

No. 38.—*Eosine on Cotton.*

Mordant in red liquor one hour; then dry; wet out, and dye cool to shade.

No. 39.—*Another way.*

Pass through a soap beck, and dry. Then work in a solution of sugar of lead; if heavy shades are required repeat in both liquors; then wash and dye at a gentle heat; for fiery shades add acetic acid.

No. 40.—*Saffronine Pink for 10 lbs. of Cotton Yarn.*

Mordant the bleached yarn cold, with 2 pounds sugar of lead, 4° B. strong for half an hour, wring out, and give it half an hour in $\frac{1}{4}$ pound Marseilles soap, and then dye at hand heat with saffronine. According to this method the pink will stand washing and the influence of the atmosphere tolerably well.

No. 41.—*To Dye Saffronine Pink on Velvets, Velveteens, and Calicoes (100 lbs.).*

Prepare your cloth with stannate of soda at 8° Tw., then sour at 11½° Tw. with vitriol; wash the cloth well in two or three cold waters, and then dye with saffronine in a jigger at 160° F. It will take about 1 pound of saffronine, according to the shade you require. Work your cloth well until all the color is extracted; wash in cold water, and it is ready for finishing.

No. 42.—*Saffronine on Cotton.*

When sufficient space for drying is available, the following is a good method to use. The cotton is mordanted in a bath of acetate of alumina standing 3° to 5° B. To fix the mordant the cotton is hung up to dry in the air for about twelve hours, and then rinsed. It is then dyed in a bath of saffronine, without the addition of acid or alkali.

To avoid the drying, proceed as follows: Pass the cotton first through a bath of sulphate alumina of 10° B., mordant strongly. After a few passages rinse, and the cotton is ready for dyeing; but for greater safety and to insure a bright and uniform color, it is advisable to subject the cotton, after drying, to a second operation similar to the first, and then to dye with a saffronine bath on a soap bath which has been cut with a little acetic acid. If it is desired to obtain a ponceau, the cotton ought to be grounded with annatto or turmeric, before it is mordanted by either of the methods just described.

No. 43.—*Dark Pink.*

For 100 kilos. (220 lbs.). Boil 5 kilos. (11 lbs.) annatto in a solution of 1 kilo. (2.2 lbs.) potash, and leave the cotton in this clear bath of a temperature of 80° R. (212° F.) for an hour, occasionally stirring it; then take it out and wash. Prepare a fresh cold bath of 2 kilos. (4.4 lbs.) alum, give the cotton 7 turns in it and wring, then make another bath with 500 gr. (17.5 ozs.) saffron carmine, and a solution of 150 gr. (5.25 ozs.) potash; introduce the cotton, stir it for an hour, lift it, add to the bath a solution of 150 gr. (5.25 ozs.) tartaric acid or a corresponding quantity of good vinegar, and immerse it in this enlivening bath. Remove the cotton, let it drip off, and dry it cold without washing.

No. 44.—*Scarlet on Cotton (60 lbs.).*

Lie down twelve hours in 20 pounds sumac, lift and give tin liquor at $2\frac{1}{2}^{\circ}$ Tw., wash three times. Dye with 2 pounds turmeric and 20 ounces saffronine more or less according to shade at 140° F.; work for half an hour.

No. 45.—*Ponceau, Saffronine, and Scarlet on Cotton, Fast.*

Pass through stannate of soda at 2° B., one hour; pass through oil vitriol bath at $\frac{1}{2}^{\circ}$ B.; wash and dye with scarlet. Then pass through tartar emetic, wring and pass through saffronine to shade, pad in 10 per cent. Turkey oil, dry and steam.

A shorter way is to prepare with Turkey red oil and mordant in acetate of alumina. Then dye as described, for scarlet add turmeric or crysodine.

No. 46.—*Crimson on Cotton.*

For 50 pounds of bleached yarn, take the yarn through the liquor of 10 pounds of boiled sumac, next, through the cold nitrate of tin mordant, thoroughly impregnating the yarn. Then pass it into a warm beck 140° F. containing a boiled liquor of 15 pounds of peachwood; after twenty minutes rinse and dry.



No. 47.—*Ponceau with Magenta on Cotton.*

The following process is recommended for the production of a fine ponceau with magenta.

The material, 10 pounds cotton yarn, is placed for a few hours in a boiling decoction of turmeric $1\frac{1}{2}$ pounds, and $\frac{1}{2}$ pound of good sumac. After opening and adding to the decoction from $\frac{1}{2}$ to $\frac{3}{4}$ pound of sulphuric acid, it is well stirred and left standing for an hour; after careful washing there remains a fine clear yellow upon the material. The yellow cotton is dyed in a warm decoction of yellow magenta, wound off and dried in a cold place. In place of sumac, flavin with cutch may be employed together; the color in this case, is still purer by a third method. The yarn may first be dyed yellow with cutch and sulphuric acid, washed, mordanted in a fresh bath with tannin, and dyed in a lukewarm bath of magenta. The color is in this case clearer, but sometimes uneven; these three processes have proved to be excellent.

No. 48.—*Red.*

For 5 kilos. (11 lbs.). *a.* Boil for an hour with $\frac{1}{2}$ kilo. (1.1 lb.) cream of tartar, $\frac{1}{2}$ kilo. (1.1 lb.) alum. *b.* Dye with a boiling solution of 100 gr. (3.5 ozs.) fuchsine and 1 kilo. (2.2 lbs.) fustic for half an hour, wash it, add to it for quarter of an hour 1 kilo. (2.2 lbs.) sumac, take it out and pass it for quarter of an hour through a bath of oxychloride of tin of 4° B., let it drip off, and finally dye the cotton for half an hour in a cold bath of $\frac{1}{2}$ kilo. (1.1 lb.) redwood and 40 gr. (1.4 ozs.) orange; then wash.

No. 49.—*Scarlet with Redwood.*

For 15 kilos. (33 lbs.). Boil with sumac and mordant the same as crimson. Give it a bath of 4 kilos. (8.8 lbs.) of redwood and $\frac{3}{4}$ kilo. (1.65 lb.) fustic, wring thrice, and give it a bath of $1\frac{1}{4}$ kilos. (2.75 lbs.) alum and $1\frac{1}{4}$ kilos. (2.75 lbs.) acetate of soda. Finish up with 4 kilos. (8.8 lbs.) redwood and 150 gr. (5.25 ozs.) naphthaline yellow. Wash, wring, and dry.

No. 50.—*Crimson.*

For 15 kilos. (33 lbs.). Boil the bleached cotton with 3 kilos. (6.6 lbs.) of sumac, and mordant with a tin salt bath composed of 2 parts of muriatic acid, 2 parts of tin salt, and 3 parts of water. Bring it to 2° B., give 5 turns, leave it there for quarter of an hour and wring 3 times. Enter the same into a cold bath of 4½ kilos. (9.9 lbs.) redwood, remove it and pass it into a second bath of 2¼ kilos. (4.95 lbs.) redwood. Wash, wring, and dry. The first bath of redwood furnishes the ground color. For all subsequent operations the last bath takes the place of the first.

No. 51.—*Dark Red.*

For 15 kilos. (33 lbs.). Mordant the same as above. Enter into a cold bath of 6 kilos. (13.2 lbs.) redwood, 1 kilo. (2.2 lbs.) fustic. Work it therein, wring three times, and leave it for an hour in a bath of ½ kilo. (1.1 lbs.) alum and ¼ kilo. (0.55 lb.) acetate soda, wring and dye with 5 kilos. (11 lbs.) of redwood and 100 gr. (3.5 ozs.) naphthaline yellow. Wring and dry. The last bath is preserved for following operations.

No. 52.—*Maroon.*

Prepare with sumac or aniline mordant, then spirit, wash, and dye with magenta or hypernic.

No. 53.—*Claret.*

Proceed as for maroon, only add logwood to shade, or from the mordant run through iron liquor instead of tin for dark colors.

No. 54.—*Chocolate or Mulberry.*

Proceed as for claret, using more logwood.

ON DYEING THE STANDARD SHADES OF NAVY BLUE ON COTTON PIECE, OR YARN.

Standard navy blue is a durable color that will stand exposure and all kinds of finishing without losing any of the hue or color,

as it can be dyed on cotton either in the raw or woven state, without the use of aniline dye. The aniline dyes are expensive and cannot be used to dye a navy blue except on a mordant, and will not be so durable as that dyed from the following receipt. I find that navy blues dyed by aniline dyes are not fast colors, and as such goods, as stockings, cotton gloves, umbrella cloth, knit goods, cotton rep, canton flannel, etc., require to be durable and of a bright color, I find the prussiate and iron blue to be far better blue than the anilines, producing better and more serviceable colors. To dye a prussiate blue, darker shades can be produced in less time by entering the goods in a bath of stannate of soda before entering the iron, as prussiate of blues are usually treated.

The best way is, to dissolve a quantity of what is called the "Standard," as you can add from that to the bath in which you are about to enter the goods. To make up the standard liquor, dissolve in a large vessel 100 pounds stannate of soda, keep stirring while it is dissolving, and cool down with cold water enough to have the solution stand 15° Tw. Have another vessel partly filled with water, and add to it 20 quarts of the Standard, then it is ready for the yarn (or piece) to be entered. The yarn or piece must be well wet out, and wrung before entering the soda bath. Enter 100 pounds cotton goods, and keep them moving for about thirty-five minutes; take out, and enter in the iron bath. This is a large vessel like the stannate tub, filled three parts full with clean water, to which are added 10 quarts nitrate of iron and 3 pints muriate of tin. Care should be taken to have them moving all the time they are in the iron bath, or the goods might not be uniform in color. The goods should be kept in the iron for forty minutes; should then be washed out well in two different clean waters. They are then ready for the prussiate bath. The prussiate bath is made in the same kind of vessel as the others, and has the same quantity of water in it before the prussiate is added. Dissolve in a separate vessel 8 pounds yellow prussiate, and add the solution to the bath with 3 pints oil of vitriol; it is then ready for the goods. Enter the goods in this bath, and keep them in motion for forty minutes. Take out, and enter the iron bath again in fresh liquor, without washing from the prussiate and vitriol; keep them in this bath for thirty minutes, wash out of the iron and tin, and repeat the

prussiate and vitriol. You have then got a nice dark prussiate blue. The goods should be taken to the washing tub and washed out well, when they will be ready to be saddened down.

A darker shade, called navy blue, is made as follows: Enter in a boiling hot bath of scalded stick logwood, and keep the goods in this for forty minutes. Lift them out, and add to them 10 quarts of red liquor. Keep in this bath for thirty minutes; wash off in clean water, and you will have a fine navy blue standard shade, which is a bright full color. Darker and lighter shades can be produced by varying the amount of logwood and red liquor in the bath. To dye this same shade with aniline dye, enter the goods in a bath of 35 pounds of sumac dissolved; keep the goods in motion forty minutes at a boil; then enter bath of nitrate of iron 12 quarts; work in this bath cold for forty minutes; take out, and wash off well. Then enter bath of prussiate and vitriol; work three-quarters of an hour in this bath boiling hot. Wash off and dissolve $\frac{1}{2}$ pound aniline purple violet. Strain off the solution, and add to it a bath of water. Enter goods at boiling point, and keep in motion for forty minutes, and wash off. This produces a very nice looking blue, but it is a fugitive color.

Another way for making a quick blue is by sumac and iron. Wash off, and then dye off with 1 pound cotton blue, 1 pound alum, and small quantity of methyl green at boiling point; wash off. This makes a fine looking blue also, and, in all respects, is equal to any shade of blue in looks, but is not durable, as for instance, if it were dyed on piece goods, the color would go down. If it were dyed on steam cylinders, and if the goods were for starchers, it would have to be raised in the starch to the required shade. I simply make this remark, as I have had a great deal of experience in dyeing blues, and also considerable trouble. I find that aniline dye is a color that you cannot always depend on, and if the goods happen to get too dark, it is some trouble to bring to the required shade, providing it is lighter. If the directions I give are followed properly, there will be no trouble in making a good and durable blue, which can always be depended on as sure and safe.

For Indigo see Vat Blues, page 112.

No. 55.—*Prussiate Blue* (30 lbs.).

Make up a cold bath of 9 ounces nitrate of iron slightly soured with vitriol. 2d. Cold water with 5 ounces yellow prussiate; give five turns in each. Add to the prussiate bath, at the last turn, $1\frac{1}{2}$ pounds spirits of salts to level the color.

No. 56.—*For Darker Shades*

use 1 pound iron and 12 ounces prussiate. Rinse, wring, and dry.

No. 57.—*Methyline Blue on Cotton.*

Work in tannin, then in tartar emetic, in a soap bath, and wash; then into a cold dye-beck, which is gradually raised to a boil. The color is best added by degrees.

No. 58.—*Methyline Blue on Cotton Piece Goods.*

(Said to stand soaping well.)

Pad with alizarin oil 1 to 16 of condensed steam water; dry, and then pad in nitrate of iron $1\frac{1}{2}^{\circ}$ Tw.; dry quite open; let hang for two days in the cold, and fix in silicate of soda at the proportion of 80 grains to 35 fluid ounces of water; wash well, and mordant with $10\frac{1}{2}$ ounces tannin to 65 gallons of water; enter at 86° F., raise in ten minutes to a boil; boil twenty minutes, drain, and wash.

To dye with water. Water 175 pints, soda ash $6\frac{3}{4}$ ounces, phosphate of soda $6\frac{3}{4}$ ounces, blue $1\frac{1}{4}$ ounce; dissolve all and filter. Enter at 86° F., raise to boil in half an hour. Wash, and dry in warm air, and calender twice. This gives a dark blue with a red reflection.

No. 59.—*For Light Shade, Fast.*

Oil as above. Pad with $\frac{3}{4}$ ounce alum to $1\frac{3}{4}$ pints of water, and dry in the stove; hang up in the cold for two days, and fix with

water, at 122° F., 175 pints, chalk 17 ounces, arseniate of soda $3\frac{1}{2}$ ounces; mordant with tannin, and dye as above.

No. 60.—*Gas-light Blue.*

Process for making mordant for gas-light blue: Boil 30 gallons of water with 30 pounds of white sugar of lead and 30 pounds of ground alum for two hours, mixing very well. Then add in small quantities 3 pounds carbonate of soda until all are dissolved. Be very careful to prevent the liquor boiling over. Let this settle, and when cold make up a stock tub and work at about 7° Tw. Preserve this stock tub for further use.

Dyeing: Bleach well, and then pass your yarns through mordant; wring from this, and dry perfectly in the stove, without washing from mordant tub. When dry, wash yarns in hot water, and wring up, then dissolve 4 ounces of night blue in 1 gallon of spirits methylated, using about 1 ounce of blue to 10 pounds of yarn. Blue should be boiled in a tin for about one hour; add this to dye tub of cold water; enter yarns, three turns; lift, and add 1 pint of acetic acid for every 10 pounds of yarn; then put in your steam-pipe; bring up your tub to the boiling point, turning over the yarns about every five minutes. The higher your temperature the greener the tints of blue on the yarns, and more bloom. Wash from this in cold water well. This is a difficult color to dye, but the above process dyes it successfully.

No. 61.—*Logwood Blue.*

For 10 kilos. (22 lbs.). Dissolve in water 700 gr. (24.5 ozs.) extract of logwood. Prepare a bath of 40° R. (122° F.) transfer the twist boiled into this bath, turn it ten times, remove and expose it to the open air during six hours, subsequently immerse it again in the same bath, turn seven times, and get ready a fresh bath of 350 gr. (12.25 ozs.) blue vitriol; give it six turns, wring, and pass it again into the extract of logwood bath, to which there have previously been added 600 gr. (21 ozs.) alum or sulphate of alumina. Turn it in this bath seven times, wring and put it back into the blue vitriol bath, wash well, and dry. Do not heat too much, for an excess of warmth will cause the twist to become spotted.

No. 62.—*Light Blue* (30 lbs.).

4 pounds Glauber's salt, 2 pounds alum, $1\frac{1}{2}$ cotton blue.

No. 63.—*Good Full Blue* (50 lbs.).

4 pounds tartaric acid, 2 pounds sal soda, 6 ounces blue.

No. 64.—*Another Way*.

10 pounds Glauber's salt, 6 pounds alum, 6 ounces blue.

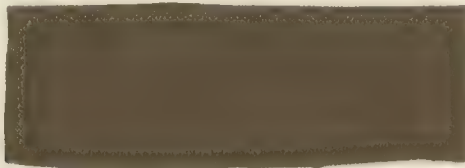
No. 65.—*Nicholson's Blues*

are mordanted with 20 per cent. sumac or $2\frac{1}{2}$ per cent. Bird's aniline mordant. Then passed through a tin liquor, and dyed at hand heat with the shade of blue required.

Aniline blues require no washing after dyeing.

No. 66.—*Brown with Cutch on Tissue*.

For 10 kilos. (22 lbs.). Dissolve in boiling water $1\frac{1}{2}$ kilo. (3.3 lbs.) brown cutch and add to the filtered decoction 200 gr. (7 ozs.) blue vitriol. Work for half an hour in this warm bath, wash, and transfer to another warm bath of 600 gr. (21 ozs.) bichromate of potassa. Work the cotton in it for a quarter of an hour, and in order to enliven the color, finish with a tepid bath containing 50 gr. (1.75 ozs.) tin salt. For the purpose of enlivening there may also be given a few turns in a bath containing 50 to 60 gr. (1.75 to 2.1 ozs.) aniline brown (Bismarck).

No. 67.—*A Fine Shade of Cure on Velvets and Velveteens*.

Run your cloth through a jigger set with cutch at 4° Tw., temperature about 180° F., give four ends through, backwards and forwards, and run through chrome at $1\frac{1}{2}$ Tw., take four ends through a jigger and wash in two waters. Sadden your cloth with three pails of fustic, six quarts of sumac liquor and six

quarts of redwood ; work your piece well, and then take off with one pint of alum at 8° Tw., and one quart of copperas at 10° Tw., in warm water ; work well and wash in two waters, get up a nice warm water. Again sadden with three pails of fustic, six quarts of sumac liquor, and six quarts of redwood ; work the pieces well, and then take off with one pint of alum 8° Tw., and one quart of copperas at 10° Tw. in warm water ; work well, and wash in two waters. Dye with one gill of annatto liquor, and work your piece well through this. It is then ready for the drain and for drying. This process will do very well for fine twills, or fine calicoes, just as well as for velvets and velveteens. The same may be also applied to yarn with the difference, that yarn has to be worked in tubs.

No. 68.—*Brown on Black Velveteen (for Job Dyers).*

Clean with hot soda water, and rinse, strip with chrome and common acid, rinse in two waters, lay them down in strong cutch bath for two nights and a day. They will do in a less time though not so well ; rinse in one water, chrome them hot, and finish to shade with logwood and Bismarck.

No. 69.—*Orange on Piece Cotton.*

Dissolve in 8 gallons boiling water 26 pounds brown sugar of lead, 14 pounds litharge, filter through calico and use it at 60° F. Take the pieces through wet, then pass them three times through cold milk of lime.

No. 70.—*Orange on Black Cotton Warps.*

For 50 pounds of black wool with white warps, run 10 pounds of the cloth at a time through a cold beck of 10 pounds of acetate of lead, previously boiled for twenty minutes with 5 pounds of litharge, then take each 10 pounds through a cold weak lime bath, and through a warm bath containing 10 pounds bichromate of potash, and through a weak lime-water.

In coloring orange on cotton, it should always be borne in mind that the fabric should not be taken directly from the lead beck into the chrome, in order to prevent the occurrence of bleared stripes.

No. 71.—*Aniline Orange on Cotton* (11 lbs.).

Pass through a warm soap bath, wring and enter in $5\frac{1}{2}$ ounces oxychloride of tin, give 10 turns, then pass to a water nearly cold containing glue, wring out and dye with $5\frac{1}{2}$ ounces orange twenty minutes, then lift and add a little acetate of alum to brighten it, wring and dry. Mixed cotton and wool will dye well this way.

No. 72.—*Orange Yellow on Cotton Tissue.*

For 20 kilos. (44 lbs.). It is an easy matter to produce handsome chrome orange colors on cotton, but in order to obtain full and even ones, the coloring matter has to be applied in correct proportions. At the same time certain precautions have to be observed, but too frequently neglected; if overlooked there are apt to occur failures which are most of the time irreparable. A bath is prepared with 4 kilos. (8.8 lbs.) sugar of lead and 2 kilos. litharge. Let this boil till everything is dissolved and the red grains of the litharge are no more perceptible. Then add sufficient amount of water; tissues are passed through this mordant twice, while twist is mordanted three or four times, and then dried; the mordant should be warm. A solution is then prepared of 4 kilos. (8.8 lbs.) chromate of potassa. The cotton will receive therein a dark yellow color, but not yet orange, it is wrung, and returned to the lead mordant, the above named manipulation is repeated, and before applying the chromate again, the following treatment is resorted to: A clear solution of lime is prepared, or milk of lime, with 1 kilo. (2.2 lbs.) quick-lime, the cotton is immersed therein several times, the solution being kept lukewarm. It is thereupon washed and returned to the chromate bath, but previous to the first immersion there are added 300 gr. (10.5 ozs.) sulphuric acid. The cotton is then immersed again, but the manipulation has now to be quickened, so as to insure evenness of color. This is facilitated by dividing the cotton into portions of 5 kilos. (11 lbs.) each, and treating these separately. After this passage the dyed cotton is washed at once in a water bath.

No. 73.—*Chrome Orange Dyeing on Cotton.*

The following method is employed to a large extent in the cotton warp trade, as well as for dyeing on cotton. The proportions are for 20 pounds of cotton in the skein. Small wooden cisterns are made just sufficient to work 20 pounds in comfortably, and which hold about 45 gallons (tubs are mostly used), 6 pounds sugar of lead and 6 pounds of unslaked lime; pour boiling water on the lime so as to boil itself to a pasty mass. This process of lime-scalding must be done in a small vessel, and having cold water ready to prevent a too powerful reaction, care being taken not to stop the boiling. This lime is then added to the sugar of lead bath, having the bath as cold as possible. Enter the cotton; give five turns, and put down all night; then lift, and keep the liquor for further use, when 4 pounds of lime and 4 pounds sugar of lead should be added to the mother liquors to produce the required shade. After lifting out in the morning, wash in cold water, and wring out; then cold water and one pint of vitriol; wash off in several waters, and wring out; then a boiling lime-water with 2 pounds of chrome. If it should be streaky or uneven, another lime and chrome will give the desired result. In order to avoid this second lime it is customary in some places to have a deeper vessel for liming, say a foot or more space between the bottom of the cotton and the bottom of the vessel, so as to put in unslaked lime to make it stronger; then the chrome is added, and the whole is boiled and allowed to settle; when all is clear, the cotton is entered and worked gently, so as not to disturb the sediment at the bottom. When a good, heavy shade is produced, care must be taken to have the sours washed well out before entering boiling lime and chrome. It is essential, also, to have the lime good.

No. 74.—*Preparation of the Milk of Lime.*

Water 20 gallons, slaked lime 11 pounds, basic acetate of lead 17 pints; stir well, and filter. Take three times through, and wash well twice. Enter the pieces in the following chrome bath in the machine (100 yards): Bichromate $15\frac{1}{4}$ ounces, sulphuric acid 28 ounces; stir well during the process. After each piece has passed through, add the same quantity of bichromate and a

little less water. Take them through boiling lime-water into water; wash four times on the machine, and dry.

No. 75.—*Process to Raise the Orange.*

After the basic acetate of lead has been fixed by milk of lime, sulphuric acid at 8° Tw., sulphate of soda, and sulphuric acid, or by liquid ammonia and carbonate of soda, or the goods have been mixed, the following alkaline chrome solution is used at a boil to redden the orange: water 212 gallons, bichromate of potash 220 pounds, lime-water 132 pounds.

No. 76.—*Orange with Annatto on Linen.*

This orange is brighter on linen than the one just described, with madder, but the color is not so fast. For 50 pounds bleached yarn boil 1 pound of annatto with 4 pounds of soda ash, pouring the whole into a kettle of hot water at 168° F. Enter the yarn, handle for fifteen minutes, rinse, and dry.

No. 77.—*Drab.* (On 15 pieces.)

Add to water 10 quarts fustic solution, 10 quarts redwood each end, run three ends, and make up fresh bath of water, to which add 3 quarts copperas solution each end. Run three ends and wash.



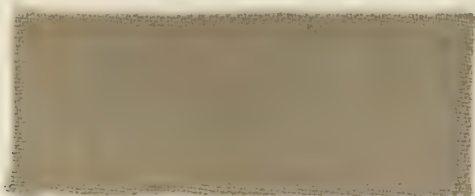
No. 78.—*Blue Drab.* (On 15 pieces.)

Dye with 8 quarts of solution of chip logwood, 1 pint extract sumac each end. Run three ends copperas, same as above, and wash off.

No. 79.—*Slate.* (On 15 pieces.)

Make up bath of water, and add to it 4 gallons logwood, standing 10° Tw. each end, with 5 ounces sal soda added to it; run

four ends, and add to water 4 quarts copperas solution; each end run four ends; wash, and take off.



No. 80.—*Drab on Cords or Fustians and Midshades.*

Sadden the goods with fustic, sumac, logwood, and 1 pint annatto; run your tub up with warm water; work the piece well; then copperas, with 4 quarts at 8° Tw., in warm water. Work the piece well; wash off in warm water with half a pot of pickle (black liquor), and then it is ready for the drain.

No. 81.—*Dark Drab on Cords.*

Same as above, only use stronger.

No. 82.—*Silver Drab on Velvets and Velveteens.*

Give your bleached cloth a nice warm water, and sadden with fustic liquor and sumac; then dye with one noggin of pure aniline blue; well take off with copperas at 8° Tw. and 1 gill of pickle in clean water; then wash, and it is ready for finishing.

The above will answer for other descriptions of cotton goods besides those specified.

For fuller description see the way cotton is filled up in the mixed goods for drab, etc., pages 152, 153.

No. 83.—*Prussiate Fast Green (23 lbs.).*

Dissolve 2 pounds 3 ounces alum in water at a hand heat. Five turns and make up a fresh water with 17 ounces solid extract of bark. Work in this for an hour and wring out three times. Make up two cold waters, the first with $8\frac{3}{4}$ ounces nitrate of iron, slightly soured with vitriol, and the second with $4\frac{3}{8}$ ounces yellow prussiate. Five turns in each, lift and wring. Add to the second water, before the last turn, 26 ounces spirit of salt to level the shade; rinse, wring and dry.

For heavier shades take extract of bark 2 pounds 3 ounces, nitrate of iron 12 ounces, yellow prussiate $10\frac{3}{8}$ ounces.



For other cotton greens and bronze, see Cotton Yarn Dyeing.

No. 84.—*Sanders Red* (100 lbs.).

Work in double muriate of tin, and without rinsing, in carbonate of soda at 4° T., rinse. Dye with 200 pounds sanders, enter at 86° F., raise to 212° F., boil for an hour, lift and wash. Add to the dye bath 1 pound tin crystals, re-enter the goods, boil for an hour, wash and air.

No. 85.—*Crimson on Cotton Flannel* (50 lbs.).

Boil out 10 pounds sumac, enter the goods in the liquor, and let steep over night. Wring out and enter in a fresh cold beck of tartar emetic, at $1\frac{1}{2}^{\circ}$ Tw. Give three or four turns, and let soak for half an hour to three-quarters. Lift and wash well two or three times. Dye in a third beck with cotton red 10 ounces. Enter at 77° F., turn quickly, and raise to 100° F.

No. 86.—*Scarlet on Cotton Flannel* (50 lbs.).

The treatment is the same as in the last receipt, but in the color bath 10 ounces cotton scarlet are used.

No. 87.—*Leather Brown Fast* (100 lbs.).

Boil out catechu 5 pounds, bluestone $5\frac{1}{2}$ ounces, extract of fustic 1 pound. Enter the cotton hot, and boil for one hour. Lift and enter in a fresh water with bichromate of potash $2\frac{1}{2}$ pounds. Raise to 212° F., boil for fifteen minutes, and wash well.

No. 88.—*Medium Dull Green Fast* (100 lbs.).

Dissolve cotton blue $2\frac{1}{4}$ ounces, alum 2 pounds, extract of fustic $2\frac{1}{2}$ pounds, extract of logwood 1 pound. Enter hot, boil for an hour, and wash well.

No. 89.—*Light Slate Gray Fast* (100 lbs.).

Dissolve extract of logwood 4 pounds. Enter the goods and boil for three-quarters of an hour; add copperas $2\frac{1}{2}$ pounds, alum 2 pounds. Boil for half an hour, lift, cool well and wash.

No. 90.—*Methyl Violet, Fast* (100 lbs.).

Steep the goods for two hours in the decoction of sumac 10 pounds. Enter in a second water of tartar emetic at $1\frac{3}{4}^{\circ}$ Tw., wash well, and dye in a third water with methyl violet $11\frac{1}{2}$ ounces, methyl green $2\frac{1}{2}$ ounces. Enter the goods at 122° F., raise to 212° F., and boil for half an hour.

The addition of methyl green reduces the brightness of the violet.

If a reddish tone is wanted, the green is left out.

Half the proportions will dye mauve as per the sample. For red shade of violet use 14 ounces 4 B violet and no green.

No. 91.—*Scarlet* (50 lbs.).

Mordant in red liquor 3° Tw. for two and a half hours, drain and wring. Dye with 22 ounces scarlet, commence at 100° F. and raise to the boil, don't wash.

No. 92.—*On Aniline Black*.

It must not be thought that aniline black has a certain fixed composition, and that every aniline black after it has been fixed on the cloth possesses the same final composition. This final composition is, on the contrary, very changeable, on which account it gives so many different kinds of aniline black in respect of their properties, as some resist more or less the influence of light and of different chemical agents, others become green, more or less easily, in contact with air containing acid or sulphurous vapors. The more intense an aniline black is the better it resists these

different agents. This intensity, indeed, depends in part upon the concentration of the colors used; but besides this there are other conditions which affect its purity; a black which is so developed in presence of an excess of aniline will always be purer than a black of the same concentration developed in presence of an excess of acid, hence it is always dangerous to use a black which is developed only in consequence of its acidity. Apart from the weakening of the texture which may be caused by it, a black color is obtained which easily turns green, and by no means bears the chlorine, which is a very great defect, as in this case, should the gas light contain only a little sulphur, the sulphurous acid formed by its combustion dyes the folds of all the pieces a greenish color. When a color contains an excess of base, on the other hand, a black is obtained less likely to turn green, and better able to bear the action of chlorine. In order that a black with excess of base may satisfy all requirements in a practical point of view, it must be developed with sufficient rapidity to avoid the escape of the aniline, but this object is easily obtained by using chlorate of aniline, instead of chlorate of potash, as by so doing, the quantity of aniline salt corresponding to the aniline in the chlorate, is diminished.

The chlorate of potash is not easily decomposed in presence of an excess of aniline. In every aniline black which contains any chlorate salt, a chlorate of aniline must always be formed; the difference consists only in this, that many print-works produce chlorate of aniline upon the cloth by a mixture of chloride of potash and aniline salt, while others print when already quite formed, but it is clear that in the duration of the so-called oxidation of aniline black, there will be a gain in proportion as the reactions which take place on the cloth can be simplified.

Aniline black may be considered as the result of two totally different reactions. 1. Decomposition of the chlorate of aniline. 2. Oxidation of the aniline salt which is mixed up with the chlorated salt. By the decomposition of the chlorate of aniline chlorinated products of aniline arise. Many degrees of substitution may thus be formed which the difference of the results would explain, but besides these chlorinated products which make up only a portion of the present aniline black, another product is formed

which is the result of the oxidation of the aniline salt. Aniline black consists, therefore, of two blacks; the one formed by the chlorinated substitutions of aniline is very pure, and resists almost all chemical agents; but this is not so fine a black as that produced by the mixture of the two blacks, which attains its perfect brilliancy and effect only by the admixture of the second product formed by the oxidation of the aniline salt. This second product has a dark violet-blue color, which in a sufficiently concentrated state is black, but it is much less pure than the former; it turns green with the smallest quantity of free acid. It completely resists the action of soap. These two blacks, the brown black and the blue black, mixed, form the present aniline black.

The experiments which gave the above results have been made with an aniline which contained toluidine and pseudotoluidine. Experiments have also been made with pure aniline, and the same results obtained, and therefore the same theory may probably be admitted for the black of these three bases. Each of these three blacks consists of two essential parts, one formed by the chlorinated substitutions of the base, and one resulting from the oxidation of the salt of the same base.

No. 93.—*Patent Aniline Black.*

J. S. Grawetz has patented the following process for the preparation of aniline black: 800 parts water, 150 parts starch, 50 parts gum, 70 parts chloride potassium, mixed together with the aid of heat. When cold, add 100 parts of aniline, 100 parts muriatic acid 1.16 ($= 32^{\circ}$ Tw.), 100 parts water, and finally fresh precipitated peroxide of iron, as obtained from 200 perchloride of iron 1.175 ($= 35^{\circ}$ Tw.). Halliday & Sons grant licenses to use it.

No. 94.—*Vanadium Aniline Black.*

Water 35 ounces, muriate aniline $2\frac{3}{4}$ ounces, chlorate potash $1\frac{3}{8}$ ounces, chloride vanadium $1\frac{1}{2}$ grains; steep the goods in this (after they are freed from dust and grease) until they are perfectly saturated with it. They are then hung up in well-oxidizing rooms at a temperature of 65° F. The heat may be raised, when they have been well opened, to 100, and kept up till the goods are dry. If deep enough (a very dark green) take them through

a bath of water in which 150 grains of chrome have been dissolved, and then dry again.

If in the first bath it did not get a deep green, after stoving, it requires to go through again before the chrome bath.

N. B.—The above will dye cotton, and double the quantity of aniline added to the other proportions will dye wool.

No. 95.—*Aniline Black (Cotton).*

(Very simple but very good.)

Take well-scoured cotton and to every pound take $3\frac{1}{2}$ ounces of sulphate of copper dissolved in water slightly acid with spirits of salt, give seven ends, and well wring. Dissolve $\frac{1}{2}$ pound hydrosulphate of soda per gallon of water at 120° F.; give five ends, and wash well. Dye cold in chlorate of potash 3 ounces, sal-ammoniac 3 ounces, muriate of aniline $\frac{1}{2}$ ounce; dissolve; then give seven quick turns, wring and heat. Hang up quite evenly, and dry at about 77° F. for forty-eight hours, then raise to 85° F. Then take through chrome or weak soda, and well wash, and dry. It should now be a good black; if, however, it should have a red reflection, a weak lime-water will jet it.

No. 96.—*Aniline Black for Dyeing Cotton.*

3 kilos. (6.6 lbs.) of iron are dissolved in 10 pounds of water and 10 kilos. (22 lbs.) of muriatic acid, the liquid diluted to 20° B., and the materials to be dyed placed in it for two hours. For 30 kilos. (66 lbs.) of material, two solutions are prepared, the first consisting of 2100 grammes (73.5 ozs.) of chlorate of potash and 30 pounds of boiling water; the second of 3 kilos. (6.6 lbs.) of aniline oil and 5 kilos. (11 lbs.) of muriatic acid. The two solutions are mixed, and the materials to be dyed dipped in till they are saturated. The impregnated materials are heated from three to five hours in a closed vessel, at first up to 30° C. (86° F.), then to 50° C. (122° F.) in a water bath. On removing from the vessel the black is fully developed. The materials are left lying together for a time, and then passed through a weak solution of chromate of potash, and then, to soften them, through a clean bath with oil. By passing the articles through very dilute sulphuric acid, wash-

ing, and passing through weak alkaline water, a dark blue is obtained from the black.

No. 97.—*Cotton Black to stand Fulling* (60 lbs.).

Extract of logwood 14 pounds, extract of bark $1\frac{1}{2}$ pounds, blue vitriol 4 pounds, dissolve at a boil, and enter the cotton-wool, and boil for an hour and a half, and let steep twelve hours; lift, and let lie in heaps two days. Take 8 pounds copperas, 2 pounds chalk, let lie in cold two hours; take out, and let lie one or two days, then wash, and raise to shade with soap and oil in warm bath.

No. 98.—*A Bright and very Deep Black for Cotton.*

In a sufficient quantity of water, 8 pounds of logwood extract, and 1 pound of quercitron are to be boiled half an hour. In this liquor 1 pound of bluestone (sulphate of copper) is to be dissolved, and the yarn put into the dye bath hot, in which it is to be worked about, and left in it for about one hour; after which the temperature is to be raised to boiling point, in which the yarn is to be boiled for about half an hour longer. Prepare another bath, containing 1 pound bichromate of potash and $\frac{1}{4}$ pound stone salt. In this put the prepared yarn, work it well about, then let the yarn cool, and afterwards wash well in water. The liquor of the latter dye bath must look a good brown color, but should the same appear rather black, a small quantity of bluestone must be added to it.

No. 99. —*Another Black a Fast Color on Cotton* (for 50 lbs. of Dry Yarn).

Soak the yarn over night in a warm solution of 15 pounds of sumac. The next morning remove the yarn, and pass it through a warm solution of 5 pounds of copperas, 1 pound of blue vitriol, and 2 pounds of whiting; then handle through a cold weak lye of lime-water; rinse the yarn, and again pass it through the sumac bath, to which have been added 6 pails of logwood liquor, and 1

pound of boiled starch. The latter will precipitate all the dye-stuff upon the yarn, and a good black, perfectly fast, will be obtained.

No. 100.—*Black on Linen* (40 lbs.).

The goods, perfectly cleansed, are steeped for an hour, in a solution of 4 pounds extract of logwood, squeeze well, and pass eight times through a cold beck of $7\frac{1}{2}$ ounces bichrome, and $\frac{3}{4}$ pound blue vitriol, squeeze, and dissolve in the old extract beck 1 pound copperas. Work for half an hour, and rinse. To hinder the goods from smearing, pass finally through water, containing a little gum or thin boiled hot starch.

No. 101.—*Another Process for Dyeing Black,*

which also produces good results, is the following. Prepare a bath containing 1 pound logwood extract, and 5 ounces fustic extract, which is sufficient for 10 pounds yarn. The yarn is to be boiled with this compound for about fifteen minutes, and left to stand over night; next morning the yarn is to be lifted out, wrung, put into a bath containing 4 ounces bichromate of potash, and about 20 ounces bluestone, and worked therein for about fifteen minutes. It is to be lifted out again and wrung. To the above logwood bath, 2 ounces crystal soda are to be added, after which the yarn is put in and worked for about half an hour and lifted out and wrung, and again put into the bichromate bath for fifteen minutes, to which have been previously added $2\frac{1}{2}$ ounces copperas. The yarn is to be wrung as before, and, lastly, it is to be returned to the logwood bath, where it remains for half an hour. After being well saturated, it is to be lifted out and wrung, and dried without washing. To give this black a nice bright finish it has to be passed once more through the logwood bath, to which has previously been added 1 ounce olive oil, mixed with half a quart of water and 1 ounce soda ash.

No. 102.—*Black (Cotton).*

For 40 yards boil or scald 10 pounds sumac, lay the cloth or yarn in this for eighteen hours, wring out, run through acetate of iron 4° Tw., four turns, or for half an hour; wring out, repeat and wash well in three waters. Then boil 25 pounds logwood and 3 pounds fustic, put off the boil, and enter, or the clear of the liquor may be decanted into another dish; one run, continue half an hour, wring out, repeat, sadden with 1 pound copperas and $\frac{1}{4}$ pound bluestone, two runs, wash and dry.

In job dyeing for a piece of cloth 20 yards, prepare a strong hot sumac like the above, then put 3 quarts slaked lime into 20 gallons water. When the lime precipitates, decant the clear into another tub; lift the cloth out of the sumac, give one run through acetate of iron, one through lime, repeat in the iron, and again through the lime. Should the cloth have got unlevel, give an extra run through the lime to make it level; then wash in two waters, and give logwood and a little fustic like the above.

No. 103.—*Black.*

For 8 kilos. (17.6 lbs.). Let the cotton boil for two hours with $\frac{1}{2}$ kilo. (1.1 lb.) logwood, 150 gr. (5.25 ozs.) fustic; take it out and immerse in a cold bath of 200 gr. (7 ozs.) lime; give it 5 turns, wring and put it into a fresh bath of $\frac{1}{2}$ kilo. (1.1 lb.) copperas, turn it a dozen times and wring. Add to the first bath 100 gr. (3.5 ozs.) caustic soda; give it 5 turns, wring and add still 150 gr. (5.25 ozs.) copperas, turn 6 times and wring.

Another black. A cold bath of 4 kilos. (8.8 lbs.) logwood, $\frac{1}{2}$ kilo. (1.1 lb.) fustic; raise this slowly to the boiling point and keep it there during half an hour, then remove it and dissolve in the bath $\frac{3}{4}$ kilo. (1.65 lbs.) copperas and 250 gr. (8.75 ozs.) blue vitriol, return the cotton to the bath, let it boil in it for half an hour and take it out. If the color is too deep, let half of the bath run off and substitute cold water for it, adding thereto $\frac{1}{2}$ kilo. (1.1 lb.) ammonia; finally work the cotton in the bath for twenty minutes.

No. 104.—*Black.*

For 100 kilos. (220 lbs.). Dissolve 15 kilos. (33 lbs.) extract of logwood, boil the cotton for an hour in it, remove, let it drip off, then spread, and leave it so for a couple of hours. Prepare a fresh bath of 30° R. (99.5 F°) with 2½ kilos. (5.5 lbs.) chromate of potassa and 2½ kilos. (5.5 lbs.) blue vitriol, work the cotton for an hour in it, take out and wash. This operation produces a bluish-black. If the cast is to be brownish instead, add to the logwood bath at a temperature of 40° R. (122° F.) 3 kilos. (6.6 lbs.) calcined soda; work the cotton for half an hour in it, take out, add 1 kilo. (2.2 lbs.) green vitriol, put the cotton back into it, and work for another half hour.

No. 105.—*Black on Cotton Velvet.*

The goods are mordanted hot for four hours with 4 pounds sumac, taken out and put for three hours in black iron liquor at 4° B., then they are taken out and passed (after being allowed to lie for some time) into a clear dung bath. They are now washed and dyed with the necessary quantity of logwood, and a little aniline violet 5° B., starting lukewarm, and going over to a hand heat. Nitrate of iron must not be used instead of the acetate or pyrolignite, as it imparts a brownish hue to the color. It is also recommended to add the aniline violet in three portions.

No. 106.—*Black Velvet Dyeing for Cotton Piece.*

The following method given is that generally adopted by the largest dye-houses in Lancashire for dyeing velvets, velveteens, cord, and fustians, black.

Before entering into the particular process it is well to remark that all the proportions given in this process are calculated for one piece, the weight of which varies from 30 to 40 pounds, and that the different mordanting and dyeing operations are generally performed in tubs holding about 50 gallons of liquor, which is the necessary quantity for dyeing one piece. The strength of the various liquors, if there is no other remark attached to it, is given according to Twaddle's hydrometer, while the wood liquors, as for

instance sumac, logwood, etc., contain for every three gallons of water about 1 pound of wood.

Run the piece first through the slop pan (boiling logwood liquor), then take off in a separate bath with alum and copperas; say, for both about two quarts, each standing 6° , after which wash and return to the slop pan. From here the goods must be again taken off in a bath prepared with alum and copperas, to which three quarts of red liquor (sesquiacetate of alumina) are added. Then wash. Dyeing—the well washed goods must now be transferred to the logwood tubs, the liquor of which is nearly boiling, or as hot as the dyer can bear it, and which is prepared as above, for three gallons of water 1 pound logwood, and in these logwood tubs the pieces must be winced for nearly half an hour.

Note.—It is generally calculated that it takes one dyer just one hour for entering, continually running backwards and forwards over the wince and cuddling two pieces.

From the logwood bath the piece must be brought to the taking-off tub, which is prepared with two quarts of alum 6° , two quarts of copperas 6° , and three quarts of red liquor. From here the piece must be lifted out, washed and returned to the logwood tub, and the same operation as just stated must be repeated. Afterwards the piece must be washed again, and returned again for the last time to the logwood tub, and then taken off in a bath prepared with four quarts of copperas 6° and washed. After washing, bring the piece into the sumac tubs, when it must be winced, etc., exactly in the same manner as in the logwood tubs, then taken off in water, to which four quarts of copperas solution have been previously added. Then wash and re-enter in the sumac tub, taking off again in a bath made up by two quarts of copperas 6° and two quarts bluestone, standing about 8° , afterwards wash in clean water.

No. 107.—*Discharging or Stripping Black Velvets, etc.*

The following proportions are given for one piece: the piece must be first boiled for about two hours in soda ash, and generally, it is calculated to take for 100 gallons of water, 30 pounds of ash. After the piece has been boiling long enough it must be lifted out and washed. Afterwards run through chemic (bleaching liquor)

standing at about 2° Tw. strong. From the chemic put it into a bath to which spirit of salt is added until the gauge-glass shows 1½°. The temperature of this bath must be somewhere near 180° F. From this acid bath the piece must be well washed, and is then ready for re-dyeing.

No. 108.—*For Re-black Velveteens.*

They look well this way: Let them be a night in sumac; rinse, and pass for fifteen minutes through tar iron bath; have ready two waters, in one put some whiting, pass through this first; afterwards the other, and dye cold with logwood and fustic. To finish, give them boiling starch water made very thin as a soap liquor. They are, when otherwise finished, brushed down with kerosene oil. This has a splendid effect.

No. 109.—*Black on Cotton, One Dip.*

For 50 pounds of yarn have in readiness a kettle containing 10 pails of logwood liquor, to which add 2 pounds of blue vitriol and 2 pounds of soda ash. When these are dissolved, cool the kettle to 180° F.; enter the dry yarn, and handle it till black.

This black will improve or deepen for three or four days after coloring, and will stand fulling and light, and is much better than most blacks.

No. 110.—*Dyeing Twist Turkey Red by Means of Alizarine.*

Artificial alizarine has of late years been generally superseding madder garancine for the purpose of dyeing a Turkey red color on twist. To every 300 kilos. (660 lbs.) twist, 9 kilos. (19.8 lbs.) calcined soda are added and boiled with them for ten to twelve hours in a high pressure boiler under a pressure 1.5 atmospheres, and then passed through 20 kilos. (44 lbs.) sheep or cow dung mixed with 45 litres (11.88 gals.) potash solution of a specific weight of 1.1598, and the necessary quantity of water. After drying the twist under a temperature 56.6° C. (134° F.) the first oil mordant is proceeded with; it receives 25 kilos. (55 lbs.) oil, 35 litres (9.24 gals.) of the above potash solution, and the residue of the previous mixture between the first and second oil mordants, the twist is again dried in the open air and then transferred to the

drying chamber which has to be heated to 56°C. (132.8°F.). The second oil mordant is composed the same as the first. It is followed by the scouring mordant of 22 litres (5.8 gals.) of potash solution, 180 litres (47.5 gals.) lixiviating broth, and the residue of both oil mordants. It is then again transferred to the drying chamber heated to 56°C. (132.8°F.), the second scouring mordant is applied the same as the first, and it is dried again in order to lixiviate the twist over night in a solution of 6 kilos. (13.2 lbs.) calcined soda, when it is submitted to another drying of 56°C. (132.8°F.). Subsequently the twist is left steeped over night in a solution of 1 to $1\frac{1}{2}$ kilos. (2.2 to 3.3 lbs.) tannin, adding nut-galls. It is then wrung and immersed in an alum mordant, in which there are either 75 kilos. (165 lbs.) sulphate of ammonia with 10 kilos. (22 lbs.) calcined soda, or 70 kilos. (154 lbs.) alum with $10\frac{1}{2}$ kilos. (23 lbs.) chalk. After again drying it is mordanted with soda and washed. The dyeing is done with 4 kilos. (8.8 lb.) alizarine, 20 litres (5.28 gals.) blood, 50 gr. (1.75 oz.) tannin, and chalk as the water may require, to every 40 kilos. (88 lbs.) twist. After dyeing it the twist is enlivened in the high pressure boiler for ten hours with 11 kilos. (23.2 lbs.) calcined soda. It is then acidulated by means of $1\frac{1}{2}$ kilos. (3.3 lbs.) tin salt, $\frac{1}{2}$ kilo. (1.1 lbs.) nitric acid, $\frac{1}{4}$ kilo. (0.55 lb.) alum, and finally there are added 10 kilos. (22 lbs.) soap, $2\frac{1}{2}$ kilos. (5.5 lbs.) soda, 1 kilo. (2.2 lbs.) tin salt, 0.3 kilo. (4.8 oz.) nitric acid, and $\frac{1}{2}$ kilo. (1.1 lbs.) annatto. It is then washed, oiled, weighted, and moistened. Dr. Theodore Kooler's latest inventions.

DYEING COTTON YARN.

No. 111.—*Alizarine Red on Cotton Yarn.*

1st bath: 1 pound alizarine assistant to 10 pounds water; work yarn half an hour at 120°F. ; wring, and dry; repeat it a second time.

2d bath: Acetate of alumina 5°Tw. , add $\frac{1}{2}$ ounce tin crystals for every 10 pounds of liquor, heat the bath to 120°F. ; work yarn three-quarters of an hour; wring, dry in the open air; then hang it in a drying-room at 140°F. four hours; age it twelve hours in a warm moist place.

3d bath: Work yarn for three-quarters of an hour in clean water at 140° F.; wash and wring.

4th bath: 25 per cent. bran; enter in cold water, heat to a boil five minutes, then take out the bran and add 8 per cent. sumac, 4 per cent. chalk, cool off the liquor to 100° F., add 8 per cent. alizarine double (Ras.), 2 per cent. dissolved glue; enter the yarn, heat to a boil in an hour and a quarter, add 6 per cent. alizarine assistant, boil yarn three-quarters of an hour.

5th bath: For 100 lbs. yarn, 4 lbs. tin crystals; work the yarn cold for half an hour, then wash.

6th bath of 6 pounds olive oil soap; work the yarn boiling for half an hour, wash.

No. 112.—*Magenta on Linen Yarn.*

Prepare the yarn in 5 lbs. of olive oil, 11 lbs. vitriol, 10 lbs. water, 10 lbs. methylated spirits, at about 60° F., and leave it in for about three hours; wring out and drain; add to this liquor, then $\frac{1}{4}$ lb. of vitriol; draw the yarn about five times through this liquor; wring and put into a magenta bath about 140° F.

No. 113.—*Fast Sanders Red for Linen Yarn* (10 lbs.).

Ground slightly with annatto; mordant by steeping over night in bichloride of tin at 8° B. Rinse and wring, and enter into a beck made up with 5 lbs. sanders to 100 lbs. goods, and work at a boil for twenty minutes. Pass sulphuric sours.

No. 114.—*Sanders Red on Cotton* (100 lbs.).

Work in double muriate of tin and without rinsing, in carbonate of soda at 4° Tw. Rinse.

Dye with 200 lbs. sanders; enter at 86° F.; raise to 212° F.; boil for an hour; lift and wash.

Add to the dye bath 1 lb. tin crystals; re-enter the goods; boil for an hour, wash and air.



No. 115.—*Mock Turkey Red* (20 lbs. cotton).

Lay down in 5 lbs. scalded sumac all night; pass 8 turns in tin liquor 3° Twaddle cold; dye with 20 lbs. barwood one hour; boil, then lift, and add $\frac{1}{4}$ pint oil vitriol; boil half an hour longer. This will very much resemble Turkey red, and is quite fast. Without the oil of vitriol it has a redder hue, but not so bright.

No. 116.—*Scarlet on Cotton Yarn* (22 lbs.).

The yarn, well bleached, is soaped hot for half an hour with 17 ozs. curd soap, and dried. It is then mordanted with strong red liquor at $6\frac{3}{4}^{\circ}$ Tw. This red liquor is made by mixing the solutions of four parts sulphate of alumina (cake-alum) and three parts sugar of lead, letting settle, and setting the clear at 63° Tw.

The yarn is then dyed with $5\frac{1}{4}$ ozs. "Scarlet 2 B Double," turning for half an hour at 112° F., and dried in heat.

No. 117.—*Fast Maroon* (22 lbs.).

Dissolve in boiling water 2 lbs. 3 ozs. brown catechu. Add to the clear liquid $4\frac{1}{8}$ ozs. bluestone. Work for half an hour in the hot liquid, wash and pass into a new hot water, containing 17 ozs. bichromate of potash. Work for fifteen minutes longer, and raise in a water containing $2\frac{5}{8}$ ozs. tin crystals at a hand heat.

No. 118.—*Pink* (100 lbs.).

1 lb. aniline, mordant first bath, run through tin liquor second bath; well wash off.

Dye with about 2 ozs. saffronine to shade.



No. 119.—*Pink or Rose with Eosine, Erythrosine, or Rose Bengale* (100 lbs.).

Prepare with 7 to 8 parts of Marseilles soap to 3 or 4 parts of glue or gelatine; run for half an hour at 100° F.; then run through cold tin liquor 5° B. for one hour; then through acetate of alumina 8° B. for two hours; wring out, and with dissolved color, dye to shade.

The above is for full deep shades. For light shades use 2 per cent. of Glauber's salt, or common salt, to 5 ozs. of color; enter at 80° to 100° F., and turn to shade at that temperature.

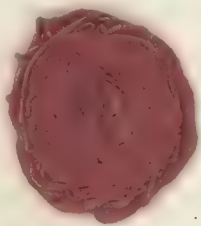
The darker shades can be raised to 200° F.

Eosine is yellow shade.

Erythrosine and phloxine are medium shades. Rose Bengale is blue shade.

No. 120.—*Scarlet* (100 lbs.).

Lay down all night in 20 pounds sumac. Run for half an hour through tin 3° Tw., wash well, dye with 2 parts saffronine, 1 part crysodine, from which it need not be washed, but will bear it if preferred. It is the fastest scarlet on cotton except Turkey red.



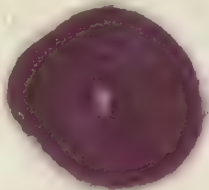
No. 121.—*Magenta* (100 lbs.).

Lay down in 10 pounds sumac, then tin for half an hour, well wash off. Dye with 8 ounces roseine.

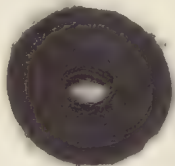


No. 122.—*Light Cardinal or Saffronine* (100 lbs.).

Proceed as for magenta, only use 1 pound saffronine ; it makes a fast red.

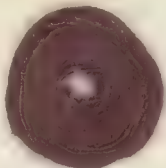
No. 123.—*Dark Cardinal*.

Dyed same as magenta, only use more of the color to shade required.

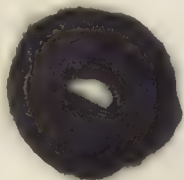
No. 124.—*Claret*.

Proceed as for magenta, only use 4 pints roseine, and 1 pint 4° B. violet.

For darker shades use more violet.

No. 125.—*Dark Claret*.

Lay down in 20 pounds sumac, then take through iron liquor, well wash off. Dye with logwood bottom first and finish in roseine, or in place of roseine use hypernic (peachwood) with the logwood.



No. 126.—*Chrysoidine on Cotton Yarn (50 lbs.).*

Prepare dye bath with 8 ounces chrysoidine. Enter yarn at 80° F.; work for fifteen minutes, lift, and raise temperature to 110° F. Add 1 pound alum, enter yarn, work for twenty minutes, wring and dry.

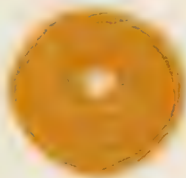
No. 127.—*For Yellow with Phosphane.*

Mordant with tannin and then run through tin liquor, wash and dye to shade.

No. 128.—*Aniline Orange.*

Same as for phosphane, only use cotton orange Y. or for red shade R.

2d plan: To the dissolved dye add from 2 to 4 per cent. alum and glue; when full enough wring and dry.

No. 129.—*Gold Color.*

Proceed as for cotton orange, only use less orange and fustic bark or turmeric to shade.

No. 130.—*Orange with Chrome on Twist.*

For 5 kilos. (11 lbs.). Boil in water 150 gr. (5.25 ozs.) litharge and 150 gr. (5.25 ozs.) acetate of lead. Let this solution settle, and let the twist remain in it an hour, remove and pass it into a fresh bath of 200 gr. (7 ozs.) slacked lime, give it seven turns, take it out and plunge it into cold water. Prepare a fresh bath of 200 gr. (7 ozs.) bichromate of potassa and 250 gr. (8.75 ozs.)

sulphuric acid. Agitate the twist during half an hour in this bath and get ready another boiling one of 250 gr. (8.75 ozs.) slacked lime, in which it is turned six times and then washed. If a reddish shade is to be given, pass the twist still into a cold bath of 10 gr. (0.35 oz.) reddish violet.

No. 131.—*Bright Yellow on Cotton Yarn* (100 lbs.).

Enter the yarn in a bath of sugar of lead 1° Tw., and work it one hour, and wring; then finish in another bath of water with the solution of 2½ pounds of bichrome, and wash off and wring out dry.



No. 132.—*Yellow with Turmeric.*

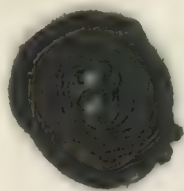
This is a fugitive color, but is easily dyed, for when full enough it only requires to be raised with tin or alum.

No. 133.—*Yellow with Fustic or Bark.*

Give the woods first and then raise with tin.

No. 134.—*Fast Indigo Green.*

Run through the indigo vat, page 168, to shade, then wash off and run one-half an hour through 3 pounds to 100 of goods, of Bird's aniline mordant, to which 4 pounds of alum have been added; then lift, and to the same liquor add fustic or quercitron to shade.



No. 135.—*Bronze on Yarn.*

Dissolve equal parts of Bismarck and aniline green, and work to shade with turmeric. It will dye without a mordant. By a mordant of tannin it will take up quicker.

Other shades may be got by bottoming with 7 pounds extract logwood and 1 pound bluestone. Wash and dye with aniline green and turmeric or other yellow to shade.



No. 136.—*Another way.*

Sumac, then iron, wash well, and dye as last to shade.



No. 137.—*Cotton Green.*

For 5 kilos. (11 lbs.). Leave the cotton for two hours in a boiling bath of 2 kilos. (4.4 lbs.) quercitron and 300 grains (10.5 ozs.) alum. Then pass it into a tepid bath of $\frac{1}{2}$ kilo. (1.1 lb.) alum and 100 grains (3.5 ozs.) indigo carmine; raise the temperature to the boiling point after having worked the cotton for one-quarter hour, let it cool off and wash. The color may be shaded at will with quercitron and indigo carmine; enliven with picric acid.

No. 138.—*Malachite Green* (50 lbs.).

Prepare with 10 pounds sumac, then run through tin liquor; wash and dye to shade with about 4 ounces of color. To yellower shades bottom with turmeric after the tin.

Methyl green, as also iodine green, has given place to malachite, as this does not with heat turn on the violet cast as methyl often does.



No. 139.—*Moss Green on Twist.*

For 10 kilos. (22 lbs.). Boil in water 1 kilo. (2.2 lbs.) sumac; in this filtered bath leave it for two hours, meanwhile prepare a fresh bath with 1 kilo. (2.2 lbs.) green vitriol; work the twist in it for a quarter of an hour, and get ready a fresh bath of acetate of alumina of 1° B.; raise the temperature to 60° C. (140° F.), turn the twist six times, take it out, wring, and immerse in a fresh bath of 750 gr. (26.25 ozs.) extract of quercitron heated to 60° R. (167° F.); work for an hour in it, and wring.

No. 140.—*Myrtle on Yarn (11 lbs.).*

Boil in a water 14 ounces sumac (or about 10 to 12 ounces good pale myrabolans); work for an hour in the clear liquid, and make up a fresh water with 26 ounces copperas; work for fifteen minutes, wring out, and make up a fresh water with red liquor at 1¼° Tw. Raise the temperature to 140° F.; ten turns, lift, wring, and enter in a fresh water of 4 pounds 5 ounces fustic, 1¾ ounces aniline brown. Heat to 140° F., work for an hour, and wring out.

No. 141.—*Peacock Green or Ceruleine on Cotton Yarn (22 lbs.).*

Mordant with 2 pounds 2 ounces curd soap, 17 ounces green olive oil, and dry at 140° F. Then mordant with red liquor at 2½° Tw., and dry again. Wet out in warm water, and dye, raising the heat to 212° F. in an hour. Boil for half an hour, lift, and enter in a boiling water with 2¾ ounces curd soap, 1⅞ ounces soda crystal; lift, and dry with heat. The dye required for the above quantity is 4 pounds 4 ounces ceruleine I. paste (of the Baden Aniline Company). It is put at once into the cold water, and stirred till dissolved.

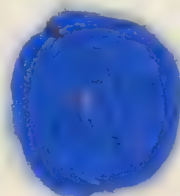
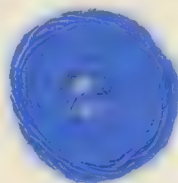
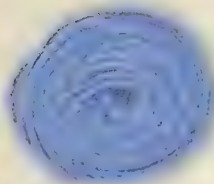
A shorter process has been latterly proposed, where the soap, oil, and red liquor are omitted, and the yarns are merely prepared with gum-tragacanth water, but in this case they must be afterwards steamed. Remember that ceruleine is rather a green than a blue.

No. 142.—*Peacock Blue or Ceruleine on Cotton Yarn.*

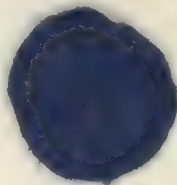
Pass through a solution of acetate of alumina of 2° B., and steam after drying. Next immerse in lukewarm water until the yarn is equally wet all through. Take for each 100 gr. (3.5 ozs.) of the prepared yarn, 20 gr. (0.7 oz.) ceruleine I. and 15 gr. (0.53 oz.) Turkey red oil, commence cold with the dyeing, slowly raise for one hour to 100° C. (212° F.), and finish by dyeing for half an hour by ebullition. After dyeing, wash with cold water, then with a boiling soap bath (3 to 4 gr. (0.1 to 0.14 oz.) per litre (2.1 pints)).

No. 143.—*Cotton Blue.*

All these are dyed in the same way, 10 per cent. alum, 5 per cent. Glauber's salt to the color as follows: for the light 4 ounces, medium 10 ounces, dark 16 ounces; enter at 100° and raise to 180° F. till dark enough. Some prefer 10 per cent. alum and 2 per cent. soda.

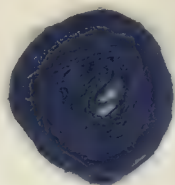
No. 144.—*Navy or Indigo Mock Blue on Yarn (11 lbs.).*

Dissolve in a hot water 3¼ ounces solid extract of logwood; enter the cotton at 122° F.; seven turns, lift, and air for eight hours. After this, return to the same water; seven turns; make up a fresh water with 5¼ ounces bluestone; seven turns, wring, and return to the logwood beck, to which have been previously added 8¾ ounces alum or cake alum; seven turns, wring, and return to the bluestone bath; rinse well, and dry in stove.



No. 145.—*Red Shade Indigo Mock Blue.*

Same as 144—topped with violet.

No. 146.—*A Fast Reddish-Brown on Twist.*

For 10 kilos. (22 lbs.). Boil in water 1 kilo. (2.2 lbs.) of cutch, let it settle, and dissolve in the filtered solution 250 gr. (8.75 ozs.) blue vitriol. Immerse the cotton after heating the decoction to 80° R. (212° F.), work for an hour, wring, and get in readiness another boiling bath of 150 gr. (5.25 ozs.) bichromate of potassa. Work for half an hour therein and wash. Boil in water 1½ kilos. (3.3 lbs.) of sumac, work for a quarter of an hour at a temperature of 70° R. (189.5° F.), lift, and add 200 gr. (7 ozs.) tin salt. Immerse the twist once more, work it for another quarter of an hour, and wring. Wind up the operation by getting ready a fresh bath of 100 gr. (3.5 ozs.) fuchsine garnet, or a very reddish violet together with 100 gr. (3.5 ozs.) alum, working the twist in it during an hour at 30° R. (99.5° F.) temperature.

No. 147.—*Reddish-Brown on Yarn (22 lbs.).*

Boil in a water 2 pounds 3 ounces catechu. Let settle, and dissolve in the clear liquid 7 ounces bluestone. Enter at 212° F., work for an hour, wring, and make up a fresh boiling water with 5¼ ounces bichromate.

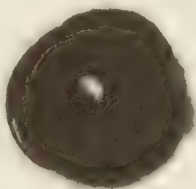


No. 148.—*Seal Brown.*

Proceed as for last, only use the same quantity of extract log-wood as of catechu.

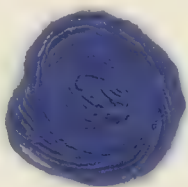
No. 149.—*For Redder Shade.*

For redder shade raise with alum, or, better still, with a weak tin liquor.

No. 150.—*Violet B.*

Prepare with tannin, and then tin, wash off, and dye to shade with dissolved color; for bluer shades use the higher No. of from 2 to 6 B.

For redder shades use magenta with it; small quantity will effect the change.



SECTION XI.

MISCELLANEOUS DYEING, CLEANING, BLEACHING, AND OTHER PROCESSES.

FEATHER CLEANING AND DYEING.

No. 1.—*To Clean White Feathers.*

Steep them in a solution of carbonate of ammonia, and, if dirty, add some soap. Gently agitate for some time till they are free from dirt and grease, then wash in warm water, and steep in a solution of bisulphate of soda; wash in warm water; pass through cold crude starch, then in the presence of heat shake or pat them till dry. Alkali blue 5 B is sometimes used to give them a blue cast, and a tinge of violet with the blue when a red reflection is required. This should be given before or in the starch liquor.

No. 2.—*Cleaning White Feathers.*

First clean from greasy matter, then place the feathers in a dilute solution of bichromate of potassa, to which a small quantity of nitric acid has been added. The greenish deposits of chromic sesquioxide which ensue may be removed by weak sulphuric acid, when the feathers will be left perfectly white.

No. 3.—*To Clean Old Feathers.*

In a nice warm soap wash them very carefully with a piece of flannel or sponge always downwards, so as not to part the plume from the stem.

When clean, wash them in warm water; then lay them down in a warm bath of salts of sorrel or oxalic acid. I prefer the former. This will bleach them. Then wash in cold water.

Then dye them white to shade with 4 B blue, and if required, a tinge of 4 B violet in with the blue, but both very sparingly.

Simply washing as described will be sufficient for feathers to be colored.

In all cases they have to be finished up out of the crude starch, as described in the following.

No. 4.—*Feather Dyeing.*

In order to dye feathers, they must previously be freed from fatty ingredients common to all feathers. This is done by means of a soda bath, which must be neither too hot nor too strong. After cleaning the feathers, all are well rinsed in pure water, and when white they will take any color.

No. 5.—*A Simple Way to Dye Feathers Brown.*

When clean, take $\frac{1}{4}$ oz. aniline mordant to each feather, scald, lay them in for ten minutes or a quarter of an hour, then pass through iron liquor, wash well, then top off with Bismarck brown. For darker shades use logwood before or after the brown, or even with it.

Note.—Feathers as a rule, if dyed in the same manner as silks, will yield good results. They should always be gotten up out of crude, that is, starch simply put into cold water, as the plumes open better from this. They should then be taken and curled on their down side, not the back to be curled, so that when about every fourth plume is turned over from the upper side down, or under side, should show in rings up the centre of the feather. Now stem them, and they are finished. To those who are particular about their looking very nice, my advice is, send them out to some man who does nothing else.

Note 2.—The mordant and iron, as recommended for brown, produces a good gray. By regulating the proportions a variety of shades can be produced, and with little additions can be changed to drab. At the same time the plan will be found of much service as a bottom for dark colors.

Note 3.—When the stem does not take so good a color as the plume, dip the finger in ammonia, and rub on; that will soften it to take the color.

No. 6.—*To Dye Feathers Black.*

Clean them with carbonate of ammonia and wash them out, then steep them for the night in nitrate of iron at 7° B., then rinse them in water. Boil out equal parts of logwood and quercitron bark, enter the feathers at a hand heat, and turn them frequently, raising the temperature slowly to a scald, but not to boiling point. Let them steep in till perfectly black; take out, and wash in warm water. Dissolve 3½ ounces bicarbonate of potash in 5 quarts of hot water, and stir in 17½ ounces of olive oil till an emulsion is produced; take them openly through this at hand heat for a short time, then gently draw all the wet out with the thumb and finger, then well shake them till dry over a stove or in a well-heated room.

No. 7.—*Black Feathers.*

As feathers especially will not take a color without previous mordanting, those intended for black must also be first mordanted. These mordants, even for black, may be of different kinds. Many dyers maintain that the feathers should be boiled with the mordant, but this is not necessary. The feathers are put into a strong nitrate of iron bath, at 15° B., left there for three hours, then rinsed out well, and afterwards dyed at hand heat, with logwood and fustic; then the bath is colored with bluestone till it appears greenish, and the feathers are left in it for three hours with frequent stirrings, after which they are well rinsed and passed through a weak chlorine bath, which gives them a fine deep black and a glossy appearance. After the chlorine bath, they are rinsed again and passed through a crude starch bath of unboiled starch, so that, on drying, they may not stick together. In this way all kinds of feathers are dyed black. The quantity of logwood and fustic for dyeing is regulated by the weight of the feathers. As a rule, the quantity of logwood taken equals one-half, and of fustic, one fourth the weight of the feathers.

No. 8.—*Black on Old Feathers.*

After washing them, let them lie in a weak soda bath at hand heat for some time, to take the old colors out; then wash in warm water, and steep them in an iron or chrome bath as described, then wash. Dye with logwood and turmeric to depth of black required; if the stems do not look black, dissolve equal parts of copperas and bluestone in the dye bath, and let them lie in for one or two hours, kept warm all the time.

If when dry they are too brown, by being over-dyed, give them a warm chloride of lime as described, starch and dry.

BLEACHING AND DYEING STRAW HATS.

No. 9.—*Bleaching Straw Hats.*

Free them from grease by a soda liquor, then moisten them with weak chloride of lime or chloride of potash, then rinse, and hang them in the sulphuring chest for two hours.

The sulphuring chamber may be made of an air-tight brick recess without any light, with poles across and wooden pegs in it, or for small lots a chest or cask will do, fitted so that after the hats are in it a cloth can cover, and a lid or door close up perfectly heat proof.

After the hats are hung up or laid on the sticks, an iron tray is partly filled with brimstone and laid in the bottom of the stove and a red-hot poker pushed into it. When kindled, the fumes of the sulphur will play all over the hats bleaching them to perfection. If, however, any of them should have been so sunburnt that they still show it, take 1 ounce salts sorrel dissolved in 1 quart of water and sponge them over, and at once put them straight into the sulphur chamber again for two hours, or instead of this second treatment, they may be steeped in a solution of bisulphate of soda. When dry they are sponged over with white gelatine in which a sprinkling of salts of sorrel has been added, then while still moist taken back for another final stoveing in the sulphur.

Straws of very fine texture will not bear the above treatment, and should be treated as follows:—

Pare a lemon, cut it in half and dip it into fine sulphur and rub it over, then well wash to remove the sulphur.

No. 10.—*Bleaching Straw Hats.*

Place the straw hats in a tub of boiling water and leave them there for the night; the next day prepare a strong bath of black soap with which they are thoroughly brushed, then without washing, put them into a sulphuring chamber during twenty-four hours, wash and dry. In order to impart to the straw the yellowish color that is so much liked, they are given a slight picric bath acidulated with sulphuric acid. They are put on the form.

No. 11.—*Bleaching Straw Hats.*

Put the straw hats into a pan of boiling water and let them steep over night. The next morning make up a strong soap beck and wash them well therein. Put them in the stove without rinsing for twenty-four hours, then rinse and dry.

To produce the yellow shade which is in such demand, give them a bath with a little picric acid soured with a little oil of vitriol, and let them dry on the block.

No. 12.—*Straw Dyeing Black* (50 hats).

Logwood chips 9 pounds, bruised galls $2\frac{1}{2}$ pounds, turmeric 9 ounces. Boil two hours, then lift them and let them steep in a bath of acetate of iron at 4° B. till black; wash, dry, and brush.

No. 13.—*Gray* (50 hats).

Only white straw will take this color. Steep in a bath of soda water in which a little lime-water has been added; the purpose of this is to remove all trace of sulphur. Take $8\frac{1}{2}$ pounds alum and 7 ounces tartaric acid, add ammoniacal cochineal and indigo paste to shade, either blue or red reflection. They are boiled in for an hour, then washed in slightly acid water.

No. 14.—*Maroon* (50 hats).

Ground sanders $1\frac{3}{4}$ pounds, turmeric $4\frac{1}{2}$ pounds, bruised galls 14 ounces, logwood, ground, 3 pounds. Boil one hour, then steep in iron liquor as for black.

2d process: Prepare with 4 pounds alum, 1 pound galls, and

No. 25.—*Cutch Brown.*

For 5 kilos. (11 lbs.) of straw hats. Boil with 500 gr. (17.5 ozs.) sulphate of alumina, 250 gr. (8.75 ozs.) bisulphate of soda, 125 gr. (4.37 ozs.) sulphuric acid. To this bath will be added the quantity of cudbear, indigo, carmine, and turmeric necessary to produce the precise cast desired, and boil to shade.

No. 26.—*Catechu Brown* (for 11 lbs. of hats).

Boil with $17\frac{1}{4}$ ounces sulphate of alumina, $8\frac{3}{4}$ ounces bisulphate of soda, $4\frac{3}{8}$ ounces oil of vitriol. Add to the bath archil, indigo, carmine, and turmeric, according to shade, and boil.

No. 27.—*Dyeing Straw Hats Black.*

In dyeing straw hats black, various difficulties are encountered, for however careful we may be, there will always be found some spots which do not sufficiently absorb the coloring matter. The experience of a great many years has taught us that this obstacle may be removed in the following manner: A lye is made of soda or potash, and there is added to it a solution of gum, the latter having been left to dissolve during twenty-four hours. After the gum and lye shall have been well mixed, the liquid is filtered through a coarse cloth of linen. The hats are then immersed in it, and left to be soaked for twelve hours. In this manner the straw is deprived of the greasy substance adhering to it. After the hats have been thoroughly dried, they are dipped in a solution of sulphate or nitrate of iron; in this cold bath the straw remains during twelve hours, when it is removed and dried. A decoction of logwood is prepared subsequently, and into this hot liquid the hats are immersed, adding thereto a slight solution of gall-nuts, sumac, or, better still, of tannin. A slight dose of bichromate of potassa will complete the result. In order to impart to the hats thus dyed the requisite amount of lustre, either gum or gelatine may be used. After all this has been done the hats are rubbed with a woollen rag, slightly moistened with oil, and finally they are rubbed over again with a perfectly clean cloth, which will take away whatever there remains of greasy substance.

No. 28.—*Black* (for 11 lbs. of hats).

Copperas 2 pounds 3 ounces, red argol 1 pound $1\frac{1}{2}$ ounces, bluestone $17\frac{1}{4}$ ounces. If possible steep the hats over night in an old black dye-beck, and dye up the next morning in a fresh water with about 4 pounds 6 ounces good logwood and a little turmeric.

No. 29.—*Another way.*

For 5 kilos. (11 lbs.) of straw hats. Boil them with 1 kilo. (2.2 lbs.) copperas, $\frac{1}{2}$ kilo. (1.1 lbs.) tartar, $\frac{1}{4}$ kilo. (0.55 lb.) blue vitriol. If possible have at your disposal an old black bath in which the hats are steeped for a night, and dye them over again in a fresh bath with about 2 kilos. (4.4 lbs.) logwood of good quality and a little turmeric.

Hats dyed by either of the above receipts will look a little brownish, but assume a fine brilliant black gloss on being brushed.

FELT, FUR, AND WOOL HAT DYEING.

No. 30.—*Remarks on Dyeing Felts.*

Felt-dyeing is essentially the same as wool-dyeing, though in practice certain modifications are rendered necessary by reason of the different nature of the hairs of the rabbit, the camel, and the beaver, which are finer and smoother than wool, and consequently assimilate mordants and coloring matters less easily. Nevertheless the mordants must not be too energetic, as the felt would otherwise lose its natural lustre, and its solidity would be greatly affected. This condition requires that the dye-beck should be kept at a well-regulated temperature lest the solidity and the brilliancy of the shades should be impaired. For reds, felts are generally dyed with cochineal or the red woods, but the preference is given to cochineal as yielding shades finer and more durable. The process is concluded with sanders or Brazil-wood according to shade.

The use of chromate of potash offers certain advantages in dyeing felts brown. The felt is boiled gently in a solution of this salt mixed with argol and sulphuric acid. The process is completed

in a new beck containing fustic, sanders, and Brazil-wood. Chromate of potash alone gives fine brown reds on dyeing up in sanders.

No. 31.—*Black for 100 Felt Hats.*

1st bath, of 56 gallons water at 112° F., add $1\frac{3}{4}$ pints of extract of chestnuts and 18 ounces soda, and heat for three-quarters of an hour, but do not boil. Take out the hats, and turn them inside out, and put them back into the liquor for half an hour, then take them up, and let them air half an hour.

2d bath, of boiling water: dissolve dry extract logwood $6\frac{1}{4}$ pounds, verdigris $2\frac{1}{4}$ pounds, copperas $8\frac{3}{4}$ pounds, extract dry fustic 7 ounces. When all are dissolved, take three parts of it out, and fill into the bath the same quantity of water. When at 100° F. the hats are turned right side out, and entered for one hour. The heat is not allowed to exceed 130° F.; it is then raised to the boil, the hats receiving two turns, and then left in for one hour, at which time they are taken out, and aired. Cool the bath, and put in half the reserved liquor. They are now entered, and turned every half hour for two hours, when the rest of the reserve liquor is added, and the bath raised to the boil for a short time. They are then taken out and aired. When cold, wash the thin ones in cold water, but the thick ones in hot. They will then be passed through an acid bath of 70 gr. (2.45 ozs.) of muriatic acid to every gallon of water, to remove all excess of copper.

The object of starting with weak liquors is to prevent hardness before the dye has penetrated. The proportions given are for medium quality; best felts require less than poor felts, as they are more porous. For hard hats the soda will be omitted. If very deep shades are wanted let them lay in the last dye bath till cold; if blue shade is required leave out the fustic.

No. 32.—*Maroon on 100 Felt Hats.*

Dissolve $1\frac{1}{2}$ pounds carbonate of soda in sufficient water to soak the hats, in which an extra pound of carbonate of soda is sprinkled as the operation proceeds. This hot bath neutralizes any acid in them.

2d bath, dry extract fustic $3\frac{1}{4}$ pounds, ground bark 18 ounces, extract dry madder 18 ounces, copperas $3\frac{1}{4}$ pounds, verdigris $10\frac{1}{2}$ ounces.

The other ingredients should be boiled before the copperas and verdigris are added. Then add 9 pounds blue archil.

Before dyeing take out 4 pails of the liquor, and fill up with cold water; enter at 112° F. They get two dippings inside and two outside, then raise the heat gradually to the boil; then take out only as many as can be opened before they get cold, for they will oxidize if let lie in heaps. The balance of the dye should be put in at each turn of the hats.

If not bright enough add more archil, then wash first in cold, then in hot water; raise with acid if too dark.

No. 33.—*Green.*

Felts are dyed green more easily than blue. A green is produced by means of extract of indigo or by prussiate of potash. The extract of indigo is dissolved, then boiled for ninety minutes with alum and tartar. The felts are lifted, and a larger or smaller quantity of flavine is put in the same beck, according to the tone of the green desired. The goods are then boiled together for about an hour. The flavine may be replaced by a decoction of bark or fustic.

All shades of green may thus be obtained, by adding to the dye beck, in the needful proportions, extract of indigo and a yellow coloring matter.

No. 34.—*To produce a prussiate green.*

The felts are first dyed blue, as previously directed for green, then rinsed, and plunged into a solution of nitrate of lead and tartaric acid, in which they are boiled for about two hours. The dyeing is then completed in a fresh beck, made up of red chromate of potash and a small quantity of nitric acid, which is heated till the desired shade is produced. The proportion of chromate of potash to be used depends on the shade required.

No. 35.—*Browns may be produced*

in a variety of ways, but sanders and Brazil with galls and sumac are most commonly used.

For fawn shades, the goods are boiled in a beck of sanders and fustic in the proportions of 3 to 2.

No. 36.—*Deeper Shades*

are produced by mixing with this beck a weak solution of copperas, and steeping the felts for fifteen to twenty minutes.

No. 37.—*The Deepest Browns, and even Blacks,*

may be produced by varying the proportions of sanders and fustic. The felts may be previously boiled in a solution of alum, argol, and a little bluestone, adding a decoction of fustic, and boiling the felts gently in this beck for two hours. They are then lifted, let cool, and drained for twenty-four hours. It is best to rinse in the washing machine, and finish in a decoction of Brazil-wood 1 part, logwood chips 4 parts.

No. 38.—*Dark Brown on Felt (35 lbs.).*

Chromate of potash $17\frac{1}{2}$ ounces, oil of vitriol $3\frac{1}{4}$ pounds. Boil for thirty minutes, lift, and add extract of logwood 4 pounds 6 ounces, acid Bismarck brown $8\frac{3}{4}$ ounces. Boil for one hour, lift, and air.

No. 39.—*Brown, one-Dip.*

Bird's dark acid brown will color fur, felt, or wool hats perfectly by simply boiling, and stand better than other browns.

No. 40.—*Black, one-Dip.*

Bird's one-dip black will color blue or jet-black in one boil in from two to four hours. They require no airing out, and will dye through. It does not rot them, and is cheaper than the old plans.

No. 41.—*Bronze, all Shades,*

as well as other colors, are now dyed in one dip by my special aniline prepared for this kind of work.

No. 42.—*To Clean White Felt Hats.*

Keep rubbing them with dry magnesia or plaster of Paris. Some use flour or pipe-clay. They are rubbed till quite clean, taking care to retain the shape.

No. 43.—*To Clean Colored Felt Hats.*

Proceed in the same manner as for white, only use dry bran, or naphtha, and holding the hat over the bowl, with a sponge keep going over it, allowing it to drip off back into the bowl. When clean, take cloths and rub till dry. Then expose to sweeten.

No. 44.—*To Clean Dark or Black Felt or Silk Hats.*

Well wash them with a sponge, or if very dirty with a hard brush till clean, and wipe them dry with a colored cloth so as not to get lint into them. Hang them up for a time until the scent is gone.

No. 45.—*Yellow,*

of all shades, presents no difficulty. The felts are boiled in a mixture of alum, tartar, and solution of tin, and then rinsed and dyed off in a flavine beck.

We may obtain another yellow in a beck of alum and tin with a decoction of fustic, but the shades are too pale for most purposes.

No. 46.—*Silver Grays*

are obtained by boiling for half an hour in a solution of tartar, gall-nuts, and extract of indigo, saddening afterwards more or less with copperas.

No. 47.—*Common Grays*

are produced by increasing the proportions of gall and copperas. For yellowish or reddish-grays, fustic or archil should be added.

No. 48.—*A Good Black*

is obtained by chromate of potash 2 pounds 3 ounces, red argol 1 pound, sulphuric acid 2 ounces. When it has boiled well the felts are entered, turned, and boiled gently for two hours.

No. 49.—*Red.*

The process for different reds is carried on as follows: A beck is filled with water, a solution of tin added, and the whole heated to a boil. The felts are then steeped in the liquid for half an hour, then taken out, and the requisite quantity of finely ground cochineal, with a suitable dose of flavine put in. The mixture is allowed to boil well, and the felts are re-entered and boiled gently and steadily. Lastly they are washed.

By working in this manner a fine scarlet is produced, and time, labor, and fuel are economized. For bluer shades leave out the flavine.

No. 50.—*Cerise.*

For a cerise tone, the felts are boiled gently for two hours in a solution of tartar, tin, and sulphuric acid, and the dyeing is effected in a cochineal beck as above. Rose shades may be dyed in an old beck which has served for scarlet or cerise, adding, according as a lighter or fuller shade is required, more or less of tartar, solution of tin, or of cochineal.

No. 51.—*Rose.*

A fine rose may be also produced by the use of alum and the finest quality of tartar, and giving the color with ammoniacal cochineal. It will be understood that to succeed with the reds just mentioned, it is necessary that the felts should be perfectly washed and bleached. For the lighter shades of yellow, red, flame-color, garnet, orange, and gold, the becks may be used which have served for scarlet and cerise, by adding a little young fustic and cochineal mixed with a solution of tin. These colors are rarely applied to felt, and we only mention them in passing.

No. 52.—*Reds.*

The shades obtained with red woods are very beautiful, but little used in felt dyeing, on account of their want of solidity. To obtain full reds with the woods, the felts are boiled in alum, free from iron, to which a little bluestone has been added, rinsed, and entered in a decoction of the best Brazil-wood. Magenta may be used for topping.

No. 53.—*Blue*

should be of a very fine quality to be suitable for felts, it may be produced with red prussiate, along with tin crystals and oxalic acid, to which is added, in a wooden beck containing pure water, a very little sulphuric acid. The felts are then plunged in, and energetically agitated in the beck. They dye up first a light green, then a deep green, then a bluish shade, which changes gradually to a deep blue, when the felts must no longer be touched.

During the latter part of the process, which lasts about an hour, the temperature is gradually raised. As soon as the goods have taken a deep blue, the beck is brought to a boil, and kept gently boiling without interruption for another hour. At the end of this time a fine blue is obtained.

According to the tone desired, either magenta or methyl-violet, may be mixed with water. For dyeing felts an aniline blue, the same method may be followed as for wool, page 114.

Indigo-carmine is very seldom used for dyeing felts blue. If it has to be employed, they are boiled for a quarter of an hour with alum and tartar, and dyed afterwards in the same beck with successive additions of dissolved extract of indigo.

BLEACHING AND DYEING OF JUTE.

No. 54.—*Bleaching Jute.*

Use soap only to scour, no alkali with it, then pass through chloride of lime at $\frac{1}{2}$ Tw., repeat from one to the other till perfect, always wash from the lime.

No. 55.—*Another Method.*

For a long time past the problem of bleaching jute without changing it has been a subject of study ; all bleachers have begun

by emphatically declaring that they were able to bleach jute as well and even better than flax and hemp, but after some experimenting they have been invariably compelled to admit that their bleaching proved to be more apparent than real; that the textile after it had remained in store for a couple of months became yellowish in appearance and devoid of strength in its texture. Some manufacturers in default of something better are content with giving the jute a cream color, and for this purpose they use rollers over which the skeins are spread and made to pass on the lower surface through a chlorine bath slightly heated; and after they have been worked therein for thirty, forty, or fifty minutes, the skeins are washed in water, wrung and dried in the open air.

On allowing the air to circulate over skeins of thread on rollers, the lower portion of the skeins only are moistened in a bath of chloride of lime; the carbonic acid of the air together with the chloride of lime produce hypochloric acid, causing the bleaching to be accelerated; it is indeed easily explained that the oxidating properties of the hypochloric acid alternate with those of the oxygen set free in the chloride of lime bath, and thus precipitate the process. It should not be overlooked that the hypochloric acid, which acts more energetically than the oxygenation produced by the chloride bath, is also less inoffensive. While we admit this method so far as the imparting of a cream color to linen or hempen thread is concerned when the spun fibre still retains all its strength, it will still be preferable to bleach by entire immersion of the thread in chloride baths of a more moderate action, which process is surer and at the same time more economical.

What has been said by us with respect to linen and hempen thread applies with more reason still to jute, a textile greatly inferior in quality to both flax and hemp.

We shall even go so far as to advance that it seems to us unavoidable that the jute should undergo a change whenever the old method of bleaching is resorted to, of giving a cream color on a roller.

Jute is little proof against the action on it of alkalines and acids; it cannot stand like flax, hemp, and cotton, the boiling with sal

soda ; under the influence of alkalines, its natural gray color turns a reddish-brown, and its fibre has a tendency to get rather quickly loosened ; acids employed even to a very limited degree produce a more thorough change still ; only chloride of lime can be applied without injurious effect, but in this instance it is imperative that the bleaching should be done by means of total immersion in the chloride bath.

The treatment of jute by its total immersion excluded from the access of air is the least offensive one ; the treatment of jute on a roller, while allowing the air to have access to it, is the most dangerous method. This is easily explained, for in the first-named process, the bleaching takes place through a slow oxygenation, while in the latter method it is the result of the rapid and energetic action of the hypochloric acid gas, as we have shown on page 234.

Both silicate and chloride of soda have been used, but without any better success, hypochlorite or chloride of lime is preferable, but suitable white color can only be reached by alternating with a soap and a chloride of lime bath.

So far as producing a cream color is concerned, we would suggest : 1st. That the jute be immersed in a weak tepid soap bath for about ten minutes. 2d. After the jute shall have been permitted to drip off, have it immersed for forty minutes and no longer in a chloride of lime bath, not exceeding in strength half a degree by the hydrometer.

As for the length of time it may be thus immersed, we must be guided by the quality of the jute, and the cast of color to be obtained ; a color whiter than cream is produced in the same manner, but with this distinction, that it should stay less time both in the soap and chlorine bath, and that the operation should be repeated several times in succession ; the oftener we repeat the operations the whiter it will become.

But whatever the color may be which we strive to get at, it will be good to wind up with two successive scourings, one in lukewarm water and one in cold water ; all that remains to be done finally, is to hang the jute out in the open air, and dry it at as low a temperature as can be done.

In order to carry out successfully the operations we have just described, it should, as much as possible, be avoided that the jute

becomes shaggy. We recommend: 1st, the skeins be strung over sticks in metallic frames which always retain the same shape; 2d, a crane should convey the skeins; 3d, the bleaching baths should be prepared in several tubs all of the same size, with or without heating apparatus, and finally, while the skeins on their frames are immersed in the one bath or the other, a mechanical motion should softly agitate them, regulating and accelerating the bleaching effect of the baths.

No. 56.—*Another Method.*

The raw material, jute fibre, is boiled two or three hours in caustic soda or milk of lime, after which it is treated with a dilute acid bath for one hour. After carefully washing, the fibre is brought into an aniline bath, to which some sulphuric acid has been added, for twelve hours. It is again washed in water and treated with a solution of manganate of soda and sulphate of magnesia, or chloride of magnesium, for one-half hour. Then treated with subsulphide of soda and diluted muriatic acid. The treatment with subsulphide of soda and muriatic acid is continued until the separated manganese is completely dissolved.—(By Dr. Julius Bidel, German patent.)

No. 57.—*Rose on Bleached Jute Yarn.*

Mordant at 122° F. in red liquor at 8° Tw., and dye in a fresh water with saffronine at the same heat.

No. 58.—*Blue on Bleached Jute Yarn (110 lbs.).*

To a warm water at 104° F., add alum 17½ ounces, soda 3½ ounces, tartar emetic 1¼ ounces. Dye with methyl-blue, soluble in water.

No. 59.—*Scarlet on Bleached Jute Yarn (110 lbs.).*

Mordant at hand heat for an hour with red liquor at 4° Tw. to which is added 17½ ounces tin crystals. Turn in a strong hot decoction of fustic; wring out and dye to shade in a fresh hand-warm water, with saffronine and a little tartaric acid.

No. 60.—*Mode Yellow on Bleached Jute Yarns.*

Mordant with acetate of alumina at $1\frac{1}{2}$ to 3° Tw.; then dye in new bath with equal parts of chrysoidine and phosphine. The colors are added in small quantities at a time till the desired shade is obtained.

No. 61.—*Copper Bronze on Jute Yarn.*

1st. Bath, of weak cutch solution at 120° F. 2d. Bath, bichromate of potash, 120° F. 3d. Bath, dye with saffronine and phosphine up to shade.

No. 62.—*Mode Green on Bleached Jute Yarns.*

Mix 3 parts fustic liquor and 1 part logwood with the necessary quantity of water at 122° F., ten turns, lift, add $\frac{1}{4}$ ounce each copperas and bluestone, re-enter, turn well and wash. Top at 86° F., with vesuvine and little methyl blue.

No. 63.—*Green Bronze on Jute Yarns.*

Add to a water at 122° F., three parts of fustic decoction to one part of logwood liquor; enter the yarns, give ten turns, lift, add a very little copperas and bluestone; re-enter, give a few more turns, and wash. Top in a fresh water at 86° F. with a little methylene blue.

No. 64.—*Gold Yellow on Bleached Jute Yarn (50 lbs.).*

Mordant with 5 pounds alum, $\frac{1}{2}$ pound tin crystals. Take the clear liquor and leave the yarn in it for half an hour. Dye in separate bath with chrysoidine and phosphine, according to shade. By passing through tartaric acid the shade will be improved.

No. 65.—*Rusty Bronze on Bleached Jute Yarns.*

1. Pass into a very weak catechu beck.
 2. Take through bichromate of potash at 122° F.
- Top with phosphine.

No. 66.—*Light Yellow on Bleached Jute Yarns.*

Mordant with red liquor at 4° Tw. and 122° F. Dye in a fresh water with phosphine at 140° F.

No. 67.—*Cerise on 22 lbs. Jute.*

Steep in $5\frac{3}{4}$ pounds hot sumac one hour, lift and dissolve $3\frac{3}{4}$ ounces tin crystals, and add it to the same sumac bath, re-enter and work quarter of an hour; well wash, and dye with cotton cardinal to shade.

No. 68.—*Brown on 22 lbs. Jute.*

Dissolve $4\frac{1}{2}$ pounds catechu and 7 ounces bluestone, and in this steep it at 212° F. for two and a half hours; wring out and make up a boiling bath 1 pound chrome, enter for half an hour. It can be made brighter by now giving it in a clean bath a little Bismarck, or for darker shades, add to the Bismarck some log-wood, with a little alum at the finish, to brighten.

No. 69.—*Red on 22 lbs. Jute.*

Steep in a clear beck of 1 pound of tannin or 2 pounds aniline mordant for one hour at 190° F.

2d. Bath at 160° F., give $5\frac{1}{2}$ ounces aniline orange, then drain and to the same liquor add $3\frac{1}{4}$ ounces saffronine, re-enter and dye to shade.

No. 70.—*Blue on Jute (200 lbs.).*

Alum 11 pounds, soda $7\frac{1}{2}$ pounds, or soda ash 3 pounds, tartar emetic $5\frac{1}{2}$ pounds; dissolve them separately, and then add them all together, and when settled pour off the clear liquor, to which are added 22 gallons water at 150° F. Add the previously dissolved color by degrees to shade. Oil of vitriol brightens, but is not recommended, as it makes it tender.

No. 71.—*Magenta on Jute.*

For dyeing this color the yarn does not require any mordant; but there are some dyers who prepare the jute in a similar way to that done on cotton, viz., sumac and stannate, or one ounce of aniline mordant to the pound.

No. 72.—*Aniline Green for Jute Yarn (45 lbs.).*

Prepare hot, with 5 pounds sumac, for about one hour, and give afterwards mordant with 4 pounds of alum and $2\frac{1}{2}$ pounds acetate of lead; leave it for a couple of hours, then dye it warm with the previously dissolved aniline green.

No. 73.—*Golden Yellow for Jute.*

For 10 kilos. (22 lbs.). Plunge the bleached jute into a tepid bath for half an hour, then wring, and give it ten turns in a fresh cold bath of 250 gr. (8.75 ozs.) bichromate of potassa until the desired shade shall have been reached, and wash. For darker shades use more acetate of lead and bichromate. In order to obtain more reddish tints pass the dyed jute into a lukewarm bath containing a little garnet or very reddish violet, previously dissolved in boiling water.

No. 74.—*Dark Green for Jute.*

For 10 kilos. (22 lbs.). Work steadily for half an hour in a warm bath containing 800 gr. (28 ozs.) extract of quercitron and 400 gr. (14 ozs.) sulphate of alumina, wring, and prepare the two following baths; 1st bath 550 gr. (19.25 ozs.) brown liquor, 100 gr. (3.5 ozs.) tin salt. 2d bath, 150 gr. (5.25 ozs.) yellow prussiate of potash. Work the jute for twenty minutes in the first bath, then wring, and pass it into the second, turn again ten times, remove it, and add 400 gr. (14 ozs.) sulphuric acid, turn again ten times, take it out, and wring.

No. 75.—*Bright Green for Jute.*

For 5 kilos. (11 lbs.). Mordant the jute for two hours with 200 gr. (7 ozs.) tannin. Prepare a fresh bath with 60 gr. (2.1 ozs.) malachite green, then immerse the jute to be worked therein during half an hour. For more yellowish casts, add to the bath according to the precise tinge to be reached, either picric acid or aniline yellow.

No. 76.—*Brown for Jute.*

For 10 kilos. (22 lbs.). Make a boiling decoction of $1\frac{1}{4}$ kilos. (2.7 lbs.) cutch brown. Dissolve therein 100 gr. (3.5 ozs.) blue

vitriol, and work the jute for an hour, wring, prepare a second boiling bath of 200 gr. (7 ozs.) bichromate of potassa, give ten turns, wash, and wring. For enlivening purposes, prepare a fresh bath of 5 gr. (0.17 oz.) Bismarck brown (aniline), 100 gr. (3.5 ozs.) sulphate of soda. In this bath try to produce the precise cast wanted; *i. e.*, for the obtainment of a reddish one, there may be added to the enlivening bath a little fuchsine or garnet.

DYEING VEGETABLE IVORY BUTTONS.

No. 77.—*Black* (for 50 gross).

Boil up 11 pounds dry extract of logwood in sufficient water to hold the buttons, enter for one hour at 190° F., stirring them all the time; take out, and cool an hour, then put them into black liquor at 5½° Tw. for half an hour, air them three hours, and give them 2 ounces of chrome for half an hour, wash, and dry.

No. 78.—*Brown*.

Boil out 5½ pounds catechu, lower the heat to 190° F., and steep them half an hour; then cool half an hour; and give them ½ pound chrome; if darker shades are required, logwood may be added to the catechu and a little bluestone.

No. 79.—*Drabs, Grays, and Modes*.

Boil out ground galls, say 5 pounds, and enter at 190° F., and let lie in for half an hour; then in black liquor; the tints can be changed by adding to the galls, fustic for drab (and fustic and madder for modes), and archil and logwood for darker hues.

No. 80.—*Olives*.

Mordant with 5 pounds alum, dye in bark liquor, then steep in black liquor, wash, and return to the bark.

No. 81.—*Spotted and Marbled Buttons*.

Spread them out on an open board and sprinkle them with spirit varnish made to the colors required; then dry them, and dye as above, but do not exceed 110° F. in the coloring.

No. 82.—*Aniline Colors for Buttons.*

Mordant them in tannin at 100° F., and for blue, use soluble blue and acetic acid.

No. 83.—*For Green.*

Use malachite, with picric acid for the yellower shades.

No. 84.—*Red.*

Is dyed with magenta.

No. 85.—*Scarlet.*

Bottom with fustic and tin or turmeric, and top with saffronine to shade.

No. 86.—*Orange.*

Use acid orange and alum.

No. 87.—*Plum.*

Bottom with orange and top with violet.

No. 88.—*Bronze.*

Use Bismarck, orange, and green in proportion to shade required.

Those dyed with aniline do not require to be rinsed from the dye, as they come up bright in the polishing.

Those dyed with mordants and woods must be rinsed and dried in a warm place, then polished in a revolving drum with chalk and the turnings of the buttons.

CLEANING, DYEING, ETC., OF MATS, SKINS, FURS,
LEATHER, ETC.No. 89.—*To Cleanse White Wool Mats.*

Rub the mats with plaster of Paris. This I have found better than any wet process. Then comb them with a horse comb.

No. 90.—*To Cleanse Colored Wool Mats.*

Wash the mats well in benzine or naphtha, taking care that all dust is out of them; then wring and dry, when they will be found to be bright and soft.

No. 91.—*Dyeing Sheep Skin Mats.*

Stretch the skin side upon a flat board, strain it as tightly as possible and tack it down firmly, or with a large needle and soft twine, draw it perfectly level to tacks or small pegs in the edge of the board. It is then turned upside down, and, by proper appliances, lowered just so far into the dye bath that the skin will not touch by an inch or so. In this way it is both dyed and dried.

Mats for re-dyeing should be served in the same way, but if there are no conveniences for the same, then two men will stand opposite each other, having first prepared the dye bath, and each hold two corners, allowing each part to dip just as much as the other, giving a gentle moving action till the operation is completed. For receipts see Wool Dyeing.

No. 92.—*To Soften Skins.*

Fix a piece of hoop iron, or something sharp, between two poles, or in any other way in which the edge side will be straight. Now let one man take two corners and another man take the other two, and keep drawing it in a down direction, backwards and forwards on the skin side, or take a cane and beat it softly, or dissolve salt 1 part and alum 3 parts, and when cold, brush it well on the skin side with a hard brush. When dry, repeat if required.

No. 93.—*To Soften Skins.*

Soak the skins in a mixture of 2 quarts of bran and 1 gallon of water for three days, take them out and rub them with a handful of salt; if they have hair or wool on, add powdered alum with the salt. Hang up to dry; when done in this manner they become soft as kid.

No. 94.—*To Clean White Furs.*

Follow the instructions as given for white felt hats, taking care however that they are rubbed only the way of the fur.

No. 95.—*To Clean Colored Furs.*

Put bran in the oven to get perfectly dry, and while still warm rub it in the down way of the fur till clean, then shake well and comb out the remainder of the bran.

No. 96.—*To Preserve the Skins of Birds and Small Animals.*

Take 1 quart of rectified spirits of wine or alcohol; methylated spirits will do if free from shellac. Add to it 1 quart of water, and dissolve in it 1 tablespoonful of corrosive sublimate. Let the skins, furs, etc., be free from dust and dirt, and then go over every part inside and out, taking care that the feathers, etc., are perfectly moistened, then hang up and dry.

No. 97.—*A Mixture to Soften Skin and Leather.*

Mix equal parts of glycerine and the yellow of eggs, and rub it in. This will soften, nourish, and on dyed leather impart a fine finish.

No. 98.—*To Clean White Kid Boots.*

Sponge well, or if much soiled brush them well over with naphtha or benzine of the purest quality till clean, then rub them with white cloth till all the spirit is taken out of them, then put them in a warm, but not hot, place to dry.

No. 99.—*To Clean Kid or Leather Gloves.*

Take pure benzine or naphtha and wash the gloves well, rubbing them all the time till clean, then squeeze them out and put them upon the hands or sticks made to fit the fingers, and rub them very quickly all over till dry, or lay them on a clean board or cloth and rub until dry. They are then smoothed and pulled into shape, and if for show in window, are held tightly to the mouth and a strong puff of wind blowed into them which swells them out to the full size and shape of the hands. The lightest colors should be done first while the spirit is clean.

No. 100.—*To Clean White Leather Gloves.*

Dissolve soap with which make a good lather and add to it finely powdered pipe clay, and at a hand heat but not more, let them be washed till clean. This operation may be performed off or on the hands. When clean, put them in shape and hang up to dry, taking care that before quite dry they are put upon an artificial hand or upon your own, it should be upon a hand the same size as the gloves. They should now be rubbed to soften them or they may dry hard or stiff.

No. 101.—*To Dye Kid Leather, Black.*

Saturate a diluted solution of bichromate of potash until the solution appears slightly, or nearly pure orange. This solution is to be applied on the side of the leather you want to dye black. Boil 4 pounds logwood, and 3 pounds fustic chips, in five gallons of water; decant the liquor from this bath, and apply it carefully on the leather. Afterwards treat it with the above bichromate of potash solution until it is quite a deep black. The leather is to be left to drain for a few hours, afterwards to be put in a bath, which is prepared by dissolving equal parts of good soap in water, to which you have added about two-third parts of olive oil, which will soften and give it at the same time a nice bright black appearance. Gloves can be dyed black by this process.

No. 102.—*Gray*

is produced by brushing on a decoction of sumac, and subsequent treatment with a weak solution of sulphate of iron; greenish-gray by the addition of fustic and logwood, also fustic and indigo carmine to the decoction of sumac. The aniline colors all fix themselves without any further addition by brushing their solutions on the glove; in place of the brush a sponge may be used when it seems suitable. In order to give black a pleasing bluish appearance after the dyeing, it may be washed with a little sal-ammoniac. Should the seams in the gloves remain white after dyeing, they are coated with a paste in which a little fat is put.

No. 103.—*On the Dyeing of Kid Gloves and Skins.*

The dye solutions are brushed over a glove; draw smoothly over a wooden hand. In order to dye black, the glove is brushed after washing it with alcohol or benzine, dried, brushed with a decoction of logwood, left for ten minutes, and brushed over once more with logwood. After ten minutes the glove is dipped into a solution of sulphate of iron, and brushed afterwards with warm water; if the color is not dark enough, add a little decoction of quercitron or fustic in the logwood bath. In place of the sulphate of iron the nitrate may be better employed. When the glove begins to

dry it is rubbed with a little olive oil, or oil soap, laid between flannel and pressed; it is then rubbed again with oil and drawn on a wooden hand. The glove must not get black on the inside, consequently none of the dye fluid should reach the inside of the glove.

Morocco red is produced by brushing on a decoction of cochineal to which a little salt of tin and oxalic acid is added; the tint is easily made darker by adding a little logwood.

Brown is dyed by brushing on a decoction of fustic, redwood, and logwood, with a little alum; the quantities of dye stuff to be used are regulated according to the tints. For darkening the color a small quantity of solution of sulphate of iron is used.

CLEANSING TISSUES WITH MINERAL OILS.

Soap has been till lately the principal agent employed for cleansing woollen goods, both for domestic and manufacturing purposes. This use, which depends on the property it possesses of dissolving fatty matters, can only be applied to articles of a simple make, and especially to fast colors, if we do not wish them to become impoverished.

Every one knows that when garments are sent to be cleaned, trimmings, embroideries, ribbons, and ornamental work of silk, wool, and fur, etc., must be taken off. To obviate this inconvenience agents have often been sought for which might supersede soap without requiring the same precaution. The attempt has been successful with the volatile products extracted from petroleum, and known under such names as naphtha, benzine, ligroine, etc. The so-called "dry cleaning" effected with these liquids is applicable to all sorts of tissues, whether the colors be fixed or fugitive. It does not affect the peculiar appearance of any tissue, and succeeds with all articles. M. Zaengerle describes a method of cleaning in use in Berlin, depending on the use of mineral oils. It is due to M. H. Drosesse. The articles to be submitted to this process must first be classed and assorted as follows:—

1st. Garments of white silk, or of very light patterns in the same material.

2d. White garments of wool, or mixed wool and cotton, or those of the same material in which white predominates.

3d. Velvets and other silken articles of the same class.

4th. Garments of pure wool, or wool and cotton of light shades.

5th. Woollen articles of deep colors and mixed tissues, if very dirty. These are treated one after another in the order indicated.

The apparatus consists of a fixed outer casing of wood lined with zinc or galvanized iron, in which a wooden drum turns, formed of two-inch pieces connected by wooden ribs or bars. The drum may be moved by an axle placed horizontally, which passes through the outer case, and carries a pulley over which passes a driving-band. The whole is so arranged that the box may be easily and rapidly opened, and the drum charged. The operator begins by introducing the liquid to be used in cleaning, naphtha, benzine, or ligroine, so that the drum may plunge into it for some three or four inches.

The articles to be cleaned are then spread upon a sloping zinc table, fitted with a ledge, well brushed with a brush well saturated with the detergent liquid. It is easy to see that the nature of the articles to be cleaned must regulate the hardness of the brush to be used, as well as the force and duration of the friction. The liquid which flows off is conducted by a gutter into a vessel placed for the purpose.

After this brushing, the articles are put in the drum, selecting, to begin with, the articles of the first class. If these are laces or other fine articles capable of escaping between the bars, they should be previously inclosed in a net. After this the box is closed, and the drum made to revolve for twenty-five to thirty minutes at the rate of twenty turns per minute. The articles of the second class may have twenty-five turns per minute for half an hour. They will have been brushed whilst the first lot was revolving, and for them the liquid may be used which ran off during the brushing of the first lot. After the first lot has been withdrawn from the drum, the second lot may be at once entered without renewing the naphtha, etc. The articles of the third class must not have more than eight to twelve turns per minute for half an hour. Those of the fourth lot turn likewise for half an hour, but at the speed of

twenty-five turns a minute. And those of the fifth class rotate at the same speed, but for three-quarters of an hour. Each lot must be brushed whilst the former one is turning, and the five classes will all in turn pass into the drum without any change of the liquid. As each charge is withdrawn from the drum it is placed in a wooden vat lined with zinc, containing pure, clear liquid, to be rinsed, after which the articles are whizzed with the greatest energy compatible with their strength and texture. It is required, in fact, to extract from them the largest possible quantity of naphtha or benzine, without the risk of tearing them. The liquid which flows from the centrifugal may be poured into the washing machine. Velvets bear whizzing worse than any other goods. As soon as they are withdrawn from the turbine, the objects are taken to a drying stove, and submitted to the most elevated temperature they can bear without injury.

By following, in the treatment of goods to be cleaned, the progressive course just described, the liquid may be used till it becomes quite black; after which it may be allowed to settle in the closed washing machine, when a clear and pure stratum rises to the top and may be immediately decanted, and can be at once used again. Nethertheless, at the end of several operations the detergent liquid becomes finally turbid, yellow, and dirty, and can only be purified by distillation. (It may be doubted whether it will be worth the time and the trouble of the garment dyer to perform this operation, except he works upon a very large scale.)

The cleaned articles are withdrawn from the stove after an hour or two, completely dry and inodorous, and are then looked over to see if they retain any saccharine or amylaceous spots. Such stains are easily removed by means of a gentle friction, after spreading the article upon a waxed cloth, applied with a sponge or with a brush, hard or soft, according to the texture of the article. Those of cloth, compact wool, etc., may be simply brushed with clear, cold water; those of silk, more or less fragile, must be carefully rubbed with pure water, mixed with a little alcohol or acid according to the nature of the colors. The moistened spots are then immediately rubbed dry with a very clear skin, and then dusted over with gypsum in an impalpable powder (we should rather recommend magnesia) to prevent the formation of a dark

ring round the spot. When thoroughly dry, this powder is removed with a soft and very clean brush, and if some traces remain they are carefully effaced with a crumb of stale bread. All these manipulations should leave no trace nor injure the freshness of the colors.

Sometimes the dry cleansing process leaves unremoved traces of stearine and of sealing wax. These may be removed with alcohol. It is not the same with old spots of oil paint, which are exceedingly tenacious; it is necessary to dissolve them with the finest olive oil. This operation is long, and renders it necessary to pass the garment once more through the cleansing process above described, to remove the oil which has dissolved the paint. In severe weather the naphtha, benzine, etc., may be carefully warmed.

The great inflammability of all these liquids makes it needful to proscribe all fires and open lights in the workroom. If heat is required, it must be obtained by means of a steam pipe.

CLEANING RIBBONS, TISSUES, KID GLOVES, Etc.

No. 104.—*Durand's Benzine.*

For a long time past the cleaning of tissues, etc., by means of benzine has come into general use, but such benzine as is procured in commerce unfortunately possesses a disagreeable smell, which adheres to tissues, etc. It contains heavy oils and greases adhering to the object treated, and they soon originate fresh spots. Public attention has consequently been directed toward analogous products, which are free from this drawback, but on the other hand do not possess all the good qualities of a well-prepared benzine. It therefore became necessary to disinfect the benzine, so as to leave its superiority and improve it, if possible, still more, and then deliver it to housekeepers, scourers, and dyers free from all foreign and obnoxious substances. Science has been appealed to, and the problem solved. The benzine invented by Mr. Durand, an apothecary at Déliovande, Calvados, France, now introduced, has none of the drawbacks alluded to, and is therefore capable of competing advantageously with all similar substances invented to perform what is to be accomplished in this line. A test can be easily made with it; it suffices to let two or three

drops fall on a piece of white paper, and after volatilization, it will be found to be as clean as it was originally. It contains no acids, and for this reason does not affect the color of tissues, not even the most tender shades. The best way to apply it is, if possible, to spread the soiled piece over a few sheets of blotting paper, and then let the benzine be absorbed by it, replace the blotting paper, and then rub repeatedly with a piece of woollen cloth impregnated with the same benzine. The volatilization takes place very rapidly, and the spot has vanished completely, for the blotting paper has absorbed it, on which it will be found transferred after volatilization of the benzine. Mr. Durand has obtained premiums at various exhibitions for this benzine, which has become quite popular.

No. 105.—*Dry Dyeing with Benzine.*

M. N. C. Armand proposes a system of dyeing in which water is dispensed with, and the aniline colors worked up with fatty matters are dissolved in benzine, mineral and vegetable essences of all sorts. It enables us to obtain the aniline colors in every shade upon silk, cotton, mixed goods, skeins, cloth, and garments.

The inventor, to overcome the difficulty of dissolving the colors in benzine, makes up the following mixture: 45 parts vegetable oil, 25 parts acetic or muriatic acid, 7 parts sulphuric ether, 7 of ammonia, 16 of potash, to be varied according to the shades desired to be obtained. To this a very gentle heat is recommended by the inventor (I fear heat would evaporate the ether). The aniline color is now added to the shade required.

The same is now mixed with benzine, or as generally known in America, naphtha, and the goods worked to shade, cold. They are then wrung and at once finished off for the market.

I am told that a celebrated firm of dyers and printers having an establishment in New York have used the dry process for their silk dyeing for two years past with success.

I cannot see what fixes the colors, neither do I think it can be so economical as the wet process, but I give it for what it is worth.

No. 106.—*Steam Dyeing by Job Dyers.*

Does it pay? Much may be said pro and con. I have had an opportunity of testing the fire and steam way, and should certainly

recommend the steam where more than three hands are kept on, but not for any less number.

WATER-PROOFING COTTON AND WOOLLEN MATERIALS.

No. 107.—*Water-proofing Linen and Cotton Fabrics.*

According to W. Green, fabrics of linen or cotton can be rendered water-proof by saturating them with a solution of gum or gelatine, containing from $\frac{1}{10}$ to $\frac{1}{50}$ of bichromate of potash, and then exposing them to sunlight. The gelatine becomes insoluble and firmly fixed to the cloth.

No. 108.—*Directions for Rendering Woollen Materials Water-proof.*

Allow one-quarter of a pound of white Marseilles soap to boil in 12 litres (3.2 gals.) water and dissolve, on the other hand 165 grams (5.8 ozs.) alum in 12 litres (3.2 gals.) water. Heat both of these solutions to 70° R. (189.5° F.). Let the stuff then pass several times through the soap bath, drawing it afterwards through the solution of alum and dry it in the air.

No. 109.—*To Render Cloth and other Materials Impervious to Water.*

Use the following mixture :—

150 grams (5.25 ozs.) of borax,
1000 grams (35 ozs.) of isinglass,
30 grams (1.05 ozs.) of sago,
20 grams (0.7 ozs.) of salip,
150 grams (5.25 ozs.) of stearine,
10 litres (2.6 gals.) of water.

A far better result is produced by passing the material to be treated through a revolving cylinder containing a solution of sugar of lead, then wringing it nearly dry, placing it afterwards in another vessel that contains a solution of sulphate of alumina, wringing it out a second time, and allowing it to dry. The cloth is then rubbed and beaten till no residue of the white precipitate which had formed upon its surface is any longer visi-

ble ; in the pores of the material sulphate of lead will then be found in very fine particles, which will prevent the penetration of water but not of air.

No. 110.—*Another Way.*

The following is also a recipe for the same purpose : Dissolve 150 grams (5.25 ozs.) of alum in 3 litres (6.3 pints) of water at 66° R. (180.5° F.), and on the other hand, 645 grams (23 ozs.) of sugar of lead in 1½ litres (3.15 pints) of water at 55° R. (155.7° F.). Pour off both solutions, stirring them well together, allow the precipitate which forms to deposit itself, and then pour off the clear fluid carefully. The material to be rendered water-proof is to be steeped for twenty-four hours in the above fluid at the ordinary temperature, after which it is dried ; it is then free from all smell and will preserve its original softness of texture perfectly.

No. 111.—*Impregnation with India-rubber.*

Mix intimately together 30 grams (1.05 ozs.) of alumina with a concentrated solution of India-rubber in oil of turpentine, and paint the mixture upon the cloth, well stretched upon a table, when it is allowed to dry. The thickness of the India-rubber coating will vary according to the number of strokes it receives from the brush, if the side not prepared with India-rubber is in any way altered, clean it with alcohol or benzine.

No. 112.—*Impenetrable Double Cloth.*

The chief peculiarity of this stuff is the close union of two materials which, without being impermeable to air, may be rendered waterproof by any of the mixtures already mentioned, or by means of the following preparation :—

9 litres (2.38 gals.) of water,
625 grms. (22 ozs.) of powdered alum, and
500 grms. (17.5 ozs.) of white lead.

When these substances have been sufficiently worked together, the clean fluid on the top is drawn off, and the cloth steeped in it until it is thoroughly saturated with liquor. Afterwards it passes

through soap, and is then washed and dried, when it will be ready for the India-rubber treatment, which is carried on thus: The solution of India-rubber is laid on the cloth in slanting lines, and similar lines are formed on the cloth that is to be placed over it, but the latter, when the two cloths have been laid the one upon the other, cut the lines of the former at right angles. By these means small squares are formed which, from their transparency, allow the free passage of steam and air, whilst moisture and rain cannot penetrate the doubly-prepared cloth.

WATER TESTS.

As good results in cleaning, bleaching, and dyeing depend so much upon the quality of the water employed, care should be taken before locating, to fully test it.

The following tests may therefore be helpful:—

Test for Hard or Soft.—Dissolve a small quantity of good soap in alcohol. Let a few drops fall into a glass of the water. If it turns milky it is hard, if not it is soft.

Test for Earthy Matters or Alkali.—Take litmus paper dipped in vinegar, and if on immersion the paper returns to its blue shade, the water does not contain earthy matter or alkali. If a few drops of syrup of violets be added to a water containing an earthy matter, it will turn green.

Test for Carbonic Acid.—Take equal parts of water and clear lime-water. If combined, or free carbonic acid is present, a precipitate is seen to which, if a few drops of muriatic acid be added, an effervescence commences.

Test for Magnesia.—Boil the water to a twentieth part of its weight, and then drop a few grains of neutral carbonate of ammonia into a glass of it, and a few drops of phosphate of soda. If magnesia be present it will fall to the bottom.

Test for Iron.—Boil a little nut-gall and add it to the water; if it turns gray or slate-black, iron is present.

2d. Dissolve a little prussiate of potash, and if iron is present it will turn blue.

Test for Lime.—Into a glass of the water put two drops of oxalic acid, and blow upon it; if it gets milky lime is present.

Test for Acid.—Take a piece of litmus paper; if it turns red there must be acid. If it precipitates on adding lime-water it is carbonic acid. If a blue sugar paper is turned red, it is a mineral acid.

Test for Copper.—If present it will turn a piece of bright polished steel a copper color.

2d. A few drops of ammonia will turn it blue if copper be present.

Test for Lead.—Take sulphurated gas water and equal quantity of water to be tested; if it contains lead it will turn a blackish-brown.

2d. The same result will take place if sulphurate of ammonia be used.

Test for Sulphur.—In a bottle of water add a little quicksilver, cork it for six hours, and if it looks dark on the top, and on shaking looks blackish, it proves the presence of sulphur.

WASTE OCCASIONED BY HARD WATER.

It has been found that one part of lime in soft soap containing silicate of soda and starch occasions the loss of 52.08; soft soap containing 36.9 per cent. of water, neutral tallow curd soap 19.80, cocoa-nut oil soap watered 61.40, glue soap containing glycerine 24.48. This shows that 1–3 cubic yards of 10° of hardness, or, what is the same thing, containing 3½ ounces of lime dissolved, will destroy 8 pounds of soft and 2½ pounds of dry curd soap.

PURIFICATION OF WATER.

It has been very aptly said a child may ask a question that would puzzle a philosopher to answer. This is apropos to the question of the purification of water, as so many attempts have been made to solve this knotty question, so as to render it fit for dyeing purposes, with only partial success; I say partial, as the ingredients used for the purpose, even supposing that they gain the end they are used for, yet leave something of their own presence behind, so that at best it is getting rid of the larger for the lesser nuisance, which no doubt is something to be thankful for. I

will, therefore, give my readers the benefit of the best-known plans for this purpose, and wait further developments, as—

For every evil under the sun
There is a remedy, or there is none.
If there's one, try and find it,
If not—never mind it.

The first is chloride of iron and milk of lime.

To prepare the chloride of iron take spirits of salts and add scrap iron as long as it dissolves without sediment, then pour off the clear liquor, and use $\frac{1}{4}$ pound of it to 35 cubic feet of the water, or to about 210 gallons; then about 12 ounces of lime are added, which will make it clear and transparent. The cost of this process may be partly recovered by using any deposits formed, as manure.

Use $\frac{1}{4}$ pound green copperas in place of the above. It is not generally known, but green copperas is a most excellent disinfectant, with this additional advantage that it has no offensive smell. Throw it into a cesspool or other nuisance and it will soon neutralize it; moreover it is a very cheap as well as safe remedy.

Alum may be used in place of either of the foregoing, or conjointly with the copperas.

Muriatic acid alone will in many cases render good service in the proportion of 2 fluid-ounces to 100 gallons of water.

Water that has been used at one factory and reaches the next, impure, even supposing it to have contained tannin or other dye wares, can be so treated by the above processes as to become quite usable.

This is a more expensive process, namely, filtering all that is required. This may be done by several means. but perhaps the best is to erect dams and let the water flow over from one into the other; by this means it gets the opportunity to settle off much of its impurities, so that the last dam will be much clearer than the first. Precaution must of course be taken in either case to remove all deposits as often as is required.

No. 113.—*To Soften Hard Well-Water.*

Hard, lime-containing water for washing, bleaching, and dyeing factories is easiest made soft and free from lime by the addition of

spirits of sal ammoniac. For each 1000 litres (264 gals.) water take $\frac{1}{4}$ litre (0.52 pint) spirits of sal ammoniac, of a strength of 0.960. Let the water settle over night, and next morning, by a faucet, drain off the clear water above the sediment.

An excellent water for dyeing also is obtained by passing steam through a vessel half filled with water, and heating it to 60° R. (167° F.). The carbonate of lime will deposit in a short time and a good water, pretty free from lime, is obtained by the use of the condensed steam.

No. 114.—*How to Soften Hard Water.*

At the recent Health Congress at Brighton, the Mayor (Alderman Hallet) read a paper on the above subject, in the course of which he said the benefits to arise from softening chalk water for drinking purposes was often discussed, but unless a water company undertook the task, consumers would continue to drink the hard water as though no remedy was within their power. His object was to state a means by which softened water could be obtained with little trouble and small expense.

It is more than a quarter of a century since Dr. Clark, of Aberdeen, made known his valuable invention, and, as the patent has expired, the application of the system is open to all who are disposed to make use of it. His description was substantially as follows:—

The invention was a chemical one for expelling chalk by chalk. Chalk consisted—for every pound (16 ozs.)—of lime, 9 ounces; of carbonic acid, 7 ounces. Nine ounces of lime, which could be obtained by burning a kiln, required at least 40 gallons of water to dissolve it. This was called lime-water. Chalk was very sparingly soluble in water, so that one pound would require 5000 gallons to dissolve it; but if there was combined with it an additional 7 ounces of carbonic acid, the chalk became readily soluble in water, and when so dissolved it was called bicarbonate of lime. If the quantity of water containing the one pound of chalk, with 7 ounces additional of carbonic acid, were 400 gallons, then the solution would be a water of the same hardness as well water from the chalk strata, and not sensibly different in other respects.

Thus it appeared that one pound of chalk, scarcely soluble in

water by either of two distinct chemical changes—soluble by being deprived entirely of its carbonic acid, when it was capable of changing water into lime-water, soluble by combining with a second dose of carbonic acid, making up bicarbonate of lime.

Now, if a solution of 9 ounces of burned lime, forming lime-water, and another solution of one pound of chalk and 7 ounces of carbonic acid, forming bicarbonate of lime, were mixed together, they would so act upon each other as to restore the two pounds of chalk, which would, after the mixture subsided, leave a bright water above. The water would be free from bicarbonate of lime; free from burned lime, and free from chalk, except a very little. A small residuum of the chalk remained, not separated by the process.

Of the $17\frac{1}{2}$ grains in a gallon of water only 16 grains would be deposited and $1\frac{1}{2}$ remain. To soften water on a small scale, it was necessary to provide lime-water about one-tenth of the quantity of water to be treated. He had used during the last twelve months two gallon stoneware casks with wooden taps. The casks were placed near a constant service tap; $1\frac{1}{2}$ pints of lime-water being first put in, the cask should be filled up to two gallons. After standing twenty-four hours, the supernatant water would be as clear as before, and at the bottom of the vessel would be found a precipitate of chalk.

The shape of the vessel would be better if cylindrical, with a tap hole a short distance up the side. This form of vessel would allow the process to be completed in twelve hours. The second cask or vessel was to form a reserve of the clear water which was being treated. He had been thus supplied without any difficulty.

There was no weighing of the lime required. If it was objected that the quantity was small, he answered, more casks could be used, or larger ones, so as to meet the requirements. This softening might easily be applied by laundresses, by using larger casks, and the saving of soap would repay them for the little trouble.

The Sixth Report of the Rivers Commission (1874), page 205, put the saving of soap by the use of lime as follows: One cwt. of lime will do the work of $20\frac{1}{4}$ cwt. of soap; cost of one cwt. quicklime, 8d.; cost of $20\frac{1}{4}$ cwt. of soap, £47 1s. 8d. There

was, therefore, very little question that the adoption of some mechanical means of mixing and rapidly filtering off the separated chalk would soon be paid for by the saving of soap.—*Journal of Gas Lighting*.

There are several other ways, such as boiling in a large vessel and drawing off for use, but as I have given the best let that suffice.

GRANT'S FILTER.

Since writing the above, I have made other inquiries and find this filter doing good service; it is made large enough for most dye-houses; it can be made to hold 4 barrels of charcoal, and by a reverse action will clean itself. For further particulars apply to the Grant Filter Co., 30 Central St., Boston.

One or two others on the same principle are now advertised.

SECTION XII.

FINISHING OF SILK, COTTON, WOOL, SHODDY, ETC.

No. 1.—*Silk.*

Silk in its natural state is not in a fit condition for taking dye or finish. It must be first cleansed, or as it is called ungummed (for the particulars of this process see Bleaching and Washing Silks, page 32), after which there are few dye-stuffs that it will not readily take up with proper treatment.

Either strong alkali or acid will dissolve it. The knowledge of its great strength, together with its lightness, saved a man's life under the following circumstances: Being placed upon a spire of a church at the time of the persecution in France, in which position he was to die unless he found a means of saving himself. Being visited daily by his wife, he called out the third day, "bring me a black beetle, a skein of silk, a ball of twine, and a strong rope, and a piece of buffalo grease."

The skein of silk was tied to the beetle's leg, the grease placed upon the front of its head, being fond of which it kept walking up to endeavor to reach it, until it arrived at the top. The silk was then hauled up; then the twine, then the rope, which was fastened securely, down which the man slipped.

Let me, however, warn the reader under no circumstances to use chloride of lime in bleaching it or trying to extract spots, not that it will not extract the spots, but will at the same time extract the fibre of the silk, and lastly, the money out of your pocket to pay for the damage.

No. 2.—*Shoddy.*

Some have a horror of the very name, and would not consent to wear such base stuff on any account, as one gentleman did some

little time ago when we were talking on this subject; and he was so emphatic upon this point that he called my attention to the suit he had on, declaring in exultation that he would never wear shoddy as long as he could get that class of wool goods.

Now, dear reader, if you should happen to meet that gentleman, do not tell him that I positively pronounce that his suit was made from shoddy!

The fact is, people confound things that differ, and come to the conclusion that they are all made from the same low materials—mill sweepings and devil's dust. While a large quantity of such low stock is made and put into heavy goods, yet some very excellent stock is made from the odds and ends of many of our large corporations who use only new wool, and from blankets, flannels, and other fine wool goods, producing a really good article, which may with positive advantage be mixed with some of the coarser wools. The curse in the thing lies in the commoner kinds being used in such a manner with good stock, but so covered up that they are not seen, and selling as best goods.

The shoddy maker is therefore a benefactor if he can take goods that were comparatively worthless and convert them into an article of utility, and he ought not to be made a scape-goat for the sins of the unprincipled manufacturer.

There are many firms in the States turning out real good shoddy by the wet principle, and at least one is running successfully on a new patent principle of making it by a dry process, which I have examined, and without hesitation pronounce it first rate. My readers who are interested in the same, may write for fuller particulars; the address is, Spencer & Evans, 799 Broadway, Brooklyn, N. Y.

The following article is smart on those who use the low class of shoddy on professed good goods. I therefore insert it to let them know that their trick is detected.

“Tennyson can take a worthless sheet of paper and by writing a poem on it make it worth \$5000 : that's genius. Mr. Vanderbilt can write fewer words on a similar sheet and make it worth \$50,000,000: that's capital. And the United States Government can take an ounce and a quarter of gold and stamp upon it an 'eagle bird' and 'Twenty Dollars:' that's money. The mechanic

can take the material worth fifty dollars and make it into a watch worth \$100: that's skill. The merchant can take an article worth twenty-five dollars and sell it to you for one hundred dollars: that's business. A lady can purchase a comfortable bonnet for ten dollars, but prefers to pay one hundred dollars for one because it's more stylish: that's foolishness. The ditch digger works ten hours a day and shovels out three or four tons of earth for one dollar: that's labor. The carpet manufacturer can (if he sees fit) lay in twenty cents' worth of cotton, cow-hair, shoddy, etc., and turn out eighty cents' worth of all-wool extra super: that's everything."

Be therefore warned in time or your goods may get scratched.

No. 3.—*Cotton.*

King Cotton reigns everywhere, and a right welcome visitor in every household of every clime; for while the American lady likes her silk and satin, and the gentleman his woollen suit (which, by the way, is the best thing for the quick changes from heat to cold), yet many hotter climes of necessity prefer the cotton or linen, while many other countries prefer it because it suits their pockets. But apart from cotton as an article of dress, it is nothing less than indispensable.

No wonder, therefore, that a very large amount of time and money have been spent in improving its manufacture, its dye, and finish, so that the number of uses to which it is applied is simply legion.

And the beautiful finish given to some of its dyed and printed goods by some modern inventions are really not only very pleasing, but astounding. Indeed I have seen some goods so beautifully finished that I have had to examine most minutely to be convinced that they were not silk, and yet they were not. The truth is King Cotton does not mind being made to look as nice as ever you like to make him, only he does not like, nor indeed will he entertain the thought that he cannot be made beautiful enough without the attempted modern plan of dissolving silk and washing his body in it, then advertising it to passers by as Mr. Silk. No, he will not

stand this imposition and dishonor to his dignity, and in hot haste he refuses to look bright, and deliberately makes short work of this mock wash, and thrusts his elbows and knees through in no time, and rubs the confounded swindle dust of his eyes, and says to the astonished beholder in resurrection tones: "Ha! ha! I am here; see!" So take my advice and do not fool with him, but treat him kindly, and, like a cat, you will find it far more convenient to stroke him the right than the wrong way.

The right way, then, is to take the cotton in its natural condition and free it from its gum. That is done by about twelve hours boil in a soda lye, and if for dyeing only requires a good washing from the lye, unless for light colors, when it is better bleached, for which see Cotton Bleaching, page 77.

Cotton, unlike silk and wool, will take but very few dyes without the assistance of a mordant. How is this? Why, cotton being neither hungry nor thirsty has to have its appetite coaxed before it can be prevailed upon to take what *we* consider to be good for it. So that mordants are really appetizers, and impart an affinity to take up, assimilate, and incorporate more or less according to the treatment of mordanting and the nature of the dye wares presented.

Some tannin substance is enough for some shades of light colors. While after tannin, others require an addition of tin or other ingredients suited to the shade required; those for dark colors are mostly run through an iron liquor after the tanning process. This causes the tan to oxidize, producing on the fibre a shade from gray to slate according to the amount used. This imparts a two-fold benefit; first, it gives not only an increased appetite to the goods, but secondly, a deep body, thus helping to produce dark colors; and treated thus, cotton and wool goods mixed together can often be dyed in one bath to match.

Cotton will stand a larger amount of alkali than wool; but, on the other hand, will become tender when much acid is used, and especially if it has to undergo a hot finish, as heat calls up the latent principles of acid. To test which, treat a piece of cotton cloth with acid to a little excess, then let it dry in the air. It may now appear comparatively strong, but put it on a hot cylinder, or hold it before a fire and it will part easily, or crisp up according

to the amount of acid in it. So that the mistake is often made of charging the dye with rotting it when it was the acid, not the dye. But as cotton is dyed so expeditiously to what it used to be, the fibre as a consequence suffers less.

No. 4.—*Wool.*

Unquestionably the most useful fibre we have, silk, is finer than cotton, yet gives much more warmth. Wool is often finer than cotton, and gives more warmth than either; being a fibre of a very spongy nature, it absorbs a large amount of greasy and extraneous matter which has to be got rid of before it will take any color well. This is much more easily effected than in the case of silk, as alkali alone is often used for dark colors, and soap combined for light, thorough washing is all that is required for wool when it has to be dyed.

When freed from such matters, it is free to absorb, I may even say it is anxious to assimilate, whatever it can as a compensation for the losses it has undergone. Most dyes it will absorb freely, many without a mordant, and nearly all with it, for which like silk it has a great tenacity, and when properly treated and dyed will hold its color for many years, if the permanent dyes are given to it.

Wool and silk contain considerable electricity, and are eminently fitted to associate closely to the magnetism of the body. Silk underwear is decidedly to be preferred to cotton, and leaves only one thing to be desired, the money to buy it.

Wool, like silk, will stand a moderate amount of alkali or acid, but as overdoses for man are neither good for body nor soul, so in like manner wool is not benefited by an excess. Indeed, acid has much the same effect on wool as spirits have on man, burning it up.

Alkali, on the other hand, if given hot and strong, will turn wool completely into grease. This action I have seen on goods dyed a fast color and tried to be extracted in too strong and too hot a bath.

If the same goods had lain for some time in the same soap and soda at not more than 100° F., they would not have been so injured, and would have discharged all their loose color. When after warm waters, it may have been passed through an acid bath, which would have raised the color much lighter, wool will bear a chloride of

lime bath, but I know of no advantage in it except for over-charged goods dyed black, which it corrects.

No. 5.—*Cotton Warp Finish.*

When in England, Mr. Hind, of Coventry, showed me an invention of his in work for finishing sewing cotton, and warps for silk mixtures, in so soft and yet so bright a manner that it could scarcely be told from silk. It consisted in the strands being passed over a hot copper cylinder on the oval; by this means more surface was obtained and the finish improved.

No. 6.—*Giving a Finish to Sewing Cotton, Twist, etc.*
(*German Method*).

Sewing cotton is finished in Germany, *i. e.*, gloss is given it by boiling in water 500 grams (17.5 ozs.) psyllium, the seed of *Plantago psyllium*, a southern plant commonly called flea grains, on account of their resemblance to fleas. This decoction is filtered and a homogeneous starch paste is made by adding 500 grams (17.5 ozs.) of wheat starch. On the other hand, a solution is made of 50 grams (1.75 ozs.) soda salt heated to 75° C. (167° F.), adding thereto, while stirring, 500 grams (17.5 ozs.) of lard. The emulsion is added to the paste which has been expanded by boiling to a volume of 40 litres (10.56 gals.). Through this dressing the skeins of cotton are passed singly. They are then washed and dried in a drying chamber at a temperature of 65° C. (149° F.). They are stretched between two pegs or rollers and brushed with a suitable brush. In this manner all light colors may be treated except white. As for black, the same composition may be used by merely adding ground plumbago to it, which blackens the dressing.

No. 7.—*A Finish which cannot be Chemically Affected*
(*M. Grouchy's Process*).

Tissues for bagging are plunged for an hour into the ensuing solution, after the latter shall have been heated to 60° C. (140° F.): Sulphate of alumina 1 kilo. (2.2 lbs.), water 25 litres (6.6 gals.),

borate of lime 1 kilo. (2.2 lbs.). The borate of lime is added after the sulphate of alumina has been dissolved in boiling water, and after settling, the whole is drawn off. After the tissues have passed through this heated liquid as has been indicated, they are at once transferred to a second bath of 1 kilo. (2.2 lbs.) resin soap, and 1 kilo. (2.2 lbs.) castile soap dissolved in 25 litres (6.6 gals.) of water made to boil. At the end of ten minutes the cloth is made to drip off, dried, then washed and dried again. Bagging thus prepared will resist the action of any acid, or chemical production which may compose the articles the bags are intended to hold.

No. 8.—*Starch in English Cotton Goods.*

The *Textile Manufacturer* of England is responsible for the following exposure.

In thread and lace goods we use about 339,317,568 pounds cotton in the home and export branches, together with haberdashery, and owing to the large extent of starch stiffenings of the finest quality they are loaded with when sold, besides the quantities used in the earlier stages of the manufacture, we may safely say that every pound of raw cotton used in them takes 50 per cent. more starch than calicoes, or $6\frac{1}{2}$ pounds of grain and potatoes, equalling 2,204,192 pounds.

The above extract only refers to one branch of manufactured textiles. Other branches are spoken of, from which it appears that the British manufacturers consume for starch 27,365,012 pounds of what is equally capable of being converted into human food. Surely the world could get along without so much starch.

No. 9.—*To prevent Gum or Stiffening from becoming Mouldy.*

Moisten the gum with alcohol, then dissolve it in water, and add a few drops of sulphuric acid. After the deposition of the precipitated calcic sulphate, a perfectly colorless solution of gum is obtained, even when inferior kinds of gum are used. Acetic acid may also be used.

No. 10.—*To prevent Flannels Shrinking.*

In a chest with a plate as a table that has been perforated place the flannels that have been previously fulled and dried; loosely put them. Then send superheated steam through the chest, which will cause a fixation of fibre. The same process will answer for unfulled flannel, only the fulled ones are more effectually fixed.

No. 11.—*Another way to prevent Woollen Goods Shrinking.*

Make up a bath of alum at 10° B., after passing the goods, say one-half hour or so, wring and dry; then wash, soap, and wash off and dry.

No. 12.—*Application of Sulphate of Barytes in Finishing Fabrics.*

The use of sulphate of barytes, for liming and finishing fabrics, has been known for a long time. The old method consists in adding the ready prepared component to the starch, or vegetable, or animal lime, but under these conditions the color of the lime is yellow, which, of course, seriously injures the white of the fabric.

The new method proposes to remove this defect. One mixes in different proportions, according to the desired strength and weight of the finishing,

1. Water.
2. Starch, or vegetable or animal lime.
3. Dryer, tournant oil, castor oil, wool oil, etc.
4. Sulphates of barytes in nascent condition, *i. e.*, the first, forming sulphate of barytes.

The most suitable proportion is the following:—

1. Water, 400 kilos. (880 pounds).
2. Starch, 100 kilos. (220 pounds).
3. Tournant oil, 10 to 20 per cent. of the weight of starch.
4. Hydro-chlorate of baryta, 10 to 20 per cent. of the weight of starch.
5. Common sulphate of 'soda, in sufficient quantity, to obtain a complete decomposition of the hydro-chlorate of baryta by chemical operation.

These different components are thoroughly intermixed, and heated with steam or other caloric agent, in order to form a paste.

The operation may be simplified by mixing the hydro-chlorate of baryta and the sulphate of soda together dry, without apprehending that they might mutually act upon and decompose each other.—[Patented by CHAUDET.]

No. 13.—*Glazed Black on Cottons.*

The cloth is grounded with a logwood bath at 3° Twaddle, then oxidized in a new bath with equal parts of bichrome and bluestone, in the usual way, washed, then topped in a fresh logwood bath, washed, and finished with the following size: 25 pounds potato starch (farina), 20 gallons water, 10 pounds logwood extract, at 30° Tw., 4 ounces bichrome, 2 ounces bluestone, 8 ounces soap, and 4 ounces wax. Dry, sprinkle, and calender with friction.

No. 14.—*Finish for Domestics.*

The bleached goods are finished while wet with the following size: 25 pounds farina, 10 pounds china clay, 10 pounds talc, 15 pounds mineral white (gypsum), 5 pounds tallow, and 1 pound soap. Dry, sprinkle, and calender.

No. 15.—*Finish with Farina.*

50 pounds farina (potato starch), 70 pounds china clay, 20 pounds talc, 40 pounds gypsum, 4 pounds soap, and 40 gallons water. Treat as above.

No. 16.—*Dyed Yarns with a Hard Finish.*

The cotton yarn which is now so extensively used as a back for velvets, satins, and other silk goods, is required to be well stiffened and even, but should not have any gloss. When it has been finished in this manner it becomes unnecessary to finish the goods, which is, in many cases, a rather costly process, as the production of this peculiar finish has not always been accompanied with the desired results for want of the proper machinery. Many manufacturers have tried to use the machines which are employed in the production of polished yarn, but in such case it is impossible to prevent the yarn getting glazed, which is not desirable.

We will therefore describe a manipulation by which a yarn answering all requirements has been obtained. The yarn is in the first instance taken in the hank and soaked in a sizing mixture whose strength varies as required. After having remained in this for some time the hanks are taken out, whizzed, and then twenty to twenty-four of them are placed upon the finishing machine. This machine contains two brass rollers placed vertically over each other, and the yarn is stretched on them to its fullest sustaining power by levers and weights; the upper roller is driven by gearing at a slow speed. Behind these rollers is a hollow steam chest placed so that it follows the course of the yarn, but remains a quarter of an inch distant from it. The steam chest has a wrought iron plate at the back, but a copper one facing the yarn, while its interior divisions are produced by the introduction of wrought iron stays, so that the steam is well distributed. In this manner the yarn gets dried in something like four minutes, while the steam from the evaporation must pass through the yarn on account of its inclination. This tends to give a good finish. The yarn will first bake together in passing before the copper plate, but will separate by coming in contact with the cold brass rollers, and in turning over them will be completely loosened. If the rollers were heated, this result could not be obtained, and it is therefore important to change the rollers with each lot of hanks. The steam in the steam chest is kept at a pressure of about sixty to seventy pounds, so as to obtain the requisite temperature. The speed of the rollers is of course a very slow one, and can be regulated according to circumstances.

It will be seen that, with the exception of the steam chest, the machine is similar to a yarn-polishing machine without the brush. As the yarn does not come in contact with any hot metal, it is said that any kind of yarn, such as cotton, woollen, silk, or linen, may be dried with advantage; and it is further asserted, that as this process does not injure most tender colors, all classes of backing yarn for silk goods may be prepared and finished on it.

No. 17.—*New Device for Raising a Nap on Cloth.*

A patent has lately been taken out in England for raising a nap on cloth, which, according to the specifications, relates, first, to

means for driving the different parts of a gig-mill or raising-machine by one main shaft; secondly, to an arrangement for throwing one or both of the cylinders in or out of gear without interrupting the continuous run of the cloth; thirdly, to an arrangement whereby the speed of the cloth may be altered while raising; fourthly, to imparting a reciprocating, endwise motion to the cylinders; fifthly, to the use of a new cleaning brush for the teasles or cards placed under the cylinders, so that the broken cards and flocks of wood cannot fall on the cloth, but fall down on the floor; sixthly, to a continuously running grinding roller for the cards, when cards are used for napping; seventhly, to an arrangement to give more or less contact of the cloth with the cylinders; eighthly, to an arrangement of two or more cylinders to raise the nap from the face and the back of the cloth at one time; ninthly, to modes of arranging and mounting rotary teasles on cylinders; tenthly, to the construction of metallic rotary teasles; eleventhly, to the employment of rotary teasles for circular and cross raising, whereby quite a new effect is obtained on the nap of the cloth.

No. 18.—*Dyeing and Finishing Woollen Goods.*

Criticism is not always welcome but still it is sometimes useful, especially if coming from successful opponents and people well acquainted with the subject under review, says the *Textile Manufacturer* in a recent issue on the above subject, and continues:—

Although we English succeed very well, on the whole, in all branches of the Dyeing and Printing trades, still, in some, we are beaten by our Continental competitors, not so much on the question of cost as on the quality, or rather for the appearance and better finish of the article.

For instance, it is a well-known fact that French manufacturers show greater taste and skill in the finishing of some woollen fabrics, like merinoes, cashmeres, etc., and it is no wonder that their goods are sometimes preferred to the English in the Bradford market itself.

In conversing lately with a French dyer who hailed from the Puteaux dyeworks, and who had come to England in search of employment, we elicited the following remarks from him, disclaiming, of course, all responsibility for his observations.

Having visited some works in Bradford he said that he found goods frequently badly dyed and finished. He saw, for instance, some fine soft merinos, of splendid appearance before dyeing, completely spoiled by the operation of dyeing and finishing. They were felted by bad treatment. The reason why such good results are not obtained at Bradford as at Puteaux is, according to him, defective modes of dyeing and finishing, which should be performed differently according to the different fabrics to be dyed, the merinos requiring one treatment, cashmeres another, and woollen muslins (*mousseline de laine*) still another manipulation.

As the latter are generally made of wool of a low quality, they are treated with an excess of alkalies, in order to clean them, and as the washing does not take the alkalinity completely away, it happens that in dyeing in an acid bath, the free alkali remaining on the wool neutralizes part of the acid, and uneven dyeing is the result. It may be, that the treatment with alkalies and subsequent washings does not deprive the wool of all its impurities, and these are the causes of the bad results. Be it as it may, it is quite certain, that, by passing these goods, before dyeing, through a bath containing 2 per cent. muriatic acid to the weight of the wool at 90° F., the defect is completely obviated and good results can be obtained. After this muriatic acid bath, the goods, if desired to be dyed black, can be brought at once into the mordant, but for other colors, they require to be washed before being mordanted.

Cashmere requires quite a different treatment, as it owes its beauty to the fineness of its grain, it happens then that its appearance is spoiled if the fabric is subjected to any rubbing during the dyeing, as this forms a slight down on its surface, so injuring the aspect and, consequently, its value. These goods are dyed at Puteaux and Reims as follows:—

After cleaning, the cashmeres are dried, then the piece is folded in two in its length, and the selvages loosely run together with very long stitches, taking care that the right side of the cloth be turned in, and is thus not exposed to any friction with the wooden rollers of the dye becks. The goods are wetted and dyed in the usual way according to the colors required. They must never be

dyed while in a dry state, but must absolutely be wetted beforehand.

There are some dyers who try to finish merinos and other tissues by passing them on the cylinder when the pieces are quite wet, and as they come out from the hydro-extractor. This is certainly a great mistake, because it has been recognized that when the merino is completely wet, and passed on the cylinder at a high temperature, it has always the tendency to felt together.

The way they are treated in France is in this fashion: After dyeing, the piece is dried, either in the stove, in the air, or on the cylinder; but in case the pieces have been dried in the stove or on the cylinder, it is necessary to let them cool. They are wetted on the surface only, in a suitable apparatus, by means of a specially prepared composition, and in this state they are passed on the cylinder, the temperature of which must be regulated according to the color of the goods, and a clever dyer can raise and diminish the shade according to the degree of heat he applies during the finishing operation. It is in the preparation of the composition for wetting the pieces on the surface, as well as in the temperature of the cylinder, and in the manipulating that lies the secret of a good finish. Better results are obtained with goods that have been dried, after dyeing, in the drying-room, which is only heated in winter time. Some dyers object to the use of the drying-room on the plea of the goods requiring a longer time for drying, and, of course, reducing the quantity of material that can be dyed and finished in one day, besides requiring large drying places. This, however, is an idle objection, since several Puteaux manufacturers can, with rather limited drying accommodation, dry and finish about 600 pieces of merino per day. 100 pieces are dried at once, and they take about four hours, so that 300 pieces can be had perfectly dry in the daytime, and 300 during the night. A good deal of the success depends also on the mode of cleaning the pieces before dyeing, and on several other details which contribute to give the goods the soft appearance, brightness to the colors, and that necessary peculiar feel between the fingers. Many dyers will have the experience that some merinos, and other woollen goods, when dyed black will show the color very unevenly. In this case it is not always the dyer who is to blame. Very

often, this unevenness of the color is caused by bad wool having been mixed with better. By passing these goods, before dyeing, through a weak muriatic acid bath, as mentioned above, even shades can always be obtained.

This dyer was astonished at the large amount of work gone through in some of the English establishments, but he does not find the works generally well built and arranged. He specially criticizes the dye-houses where the amount of steam fills the place completely, and it is next to impossible to distinguish the colors properly, and the foreman has to take the piece out of the dye-house to see if it matches the shades.

Having pointed out the defects, the remedy can be easily found. The English dyers and finishers of the woollen goods above mentioned, must follow the methods successfully employed by the French, and if they cannot succeed by themselves, it is clear that the only remedy lies in engaging French dyers and finishers of the above articles to show them the way. This is certainly better than losing the trade altogether.

No. 19.—*To Render Wood and Tissues Non-inflammable.*

The "Société d'Encouragement pour l'Industrie" has invited answers to the question: How to render wood-work and tissues non-inflammable. Jean Abel Martin proposed the following mixtures, which have been accepted by the society. 1. For light tissues: pure sulphate of ammonia, 8 parts; pure carbonate of ammonia, 2.5; boric acid, 3; pure borax, 2; starch, 2 (or gelatine, 4, or dextrine, 4); water, 100. For use, steep the tissue in the solution at a temperature of 30° Reaumur, and saturate it thoroughly; dry it in the ordinary manner as is done with starched articles prior to ironing them. The quantity of starch, dextrine, or gelatine may vary in accordance with the stiffness desired to be imparted to the article. The price amounts to very little—about fifteen centimes per litre, which is enough for about fifteen metres of tissue. 2. Mixture applicable to decorations already painted, to canvas already mounted, to wood, furniture, window casings, etc.—it is applied at a temperature of 55° to 60° R., with a brush, like ordinary paint: chlorhydrate of ammonia, 15 parts; boric acid, 5; skin glue, 50; gelatine, 1; water, 100; lime to give it

the requisite consistence. For canvas already painted, it suffices to give a coating on the back of the painting, and to treat the frames to a like application. 3. Mixture for coarse cloths, cordages, or straw mattings, as well as wood—it is to be applied at a temperature of 100° , and the immersion must last fifteen or twenty minutes; wring lightly, and let dry: chlorhydrate of ammonia, 15 parts; boric acid, 6; borax, 3; and water, 100. 4. Mixture for paper, painted or not—this solution is used at a temperature of 50° : sulphate of ammonia, 3 parts; boric acid, 3; borax, 2; and water, 100.

No. 20.—*The Way to Wash Mixed Dye Goods.*

When dyed they should be washed off well, or the color will smut, and if they are not washed off well, they do not look as well as those that have been washed. I find the best mode of washing is: When they come out of the dye tub enter them in a dash wheel and dash them out, and they will be sure to be well washed. The wheel is made of wood, is round, and about twelve inches wide, and closed up on both sides, and partitioned off in four separate apartments. Inside, on the front of this wheel, are four openings up to the top. Each opening is for the apartment that the goods are put into. On the back of the wheel is a space cut about two inches all around the wheel. In this space is placed a water pipe to supply water enough to wash the goods inside the wheel. The wheels are all sizes. Through the centre of the wheel a shaft is run, and on the end is a wheel or small pulley to start the wheel by. You can put a certain amount of goods in one of these wheels, start on the water, and also start the wheel revolving about forty revolutions a minute, and in fifteen minutes you can dash out or wash 40 dozen pairs of stockings or 100 pounds of cloth or yarn, or any kind of goods that want washing thoroughly. It is also a great help to job dyers, as it saves a deal of labor and can be entered right from the dye tub into this wash wheel, and it washes the goods better than any other way I know of.

No. 21.—*M. Garmer's System of Finishing Tissues.*

This method has the advantage that it does not crush the fibre, and that if desired, it does not give too much dressing, nor does it

penetrate through the tissue. It will at the same time take the place of sponging with many articles. A wooden rule is used covered with molton (so-called swanskin), the lower side being dipped into a bath of starching paste in a double-bottomed boiler. This molton does the glossing. This rule is supported by a second (metallic) rule resting upon the rim of the starch boiler. The tissue to be dressed starts from a roller, then passes over another roller, still another one vertically placed and movable, and passing upon the wooden rule, where it is impregnated with paste, thence passes to a third roller, then to go on a drying drum, whence it is transferred to a second roller of cloth, after having been guided on its way by a last roller. The movable roller to which allusion has been made enables us to bring into contact with the molton more or less cloth, and therefore to regulate to a nicety the amount of finish the latter is to receive. Any kind of dressing may be employed in conjunction with this apparatus.

No. 22.—*Apparatus for a Uniform Distribution of Finish,*
by Mr. Blow.

This apparatus chiefly consists of two pairs of cylindrical brushes, either of horse-hair or felt, obliquely placed one upon the other, between which the tissue passes when it issues from the glue tub, the paste tub or the dyeing vessel. The brushes move a little faster than the tissue when it passes into the tub, and in this manner the liquid coat becomes uniform, all unevenness being removed by the brushing. The pairs of brushes are moreover of different lengths, the inner extremities of one of the pairs extending beyond the inner extremities of the other, thus leaving on the surface of the tissue no line of division.

No. 23.—*Beating Machine for Tissues.*

Mr. Jouffray has invented a machine of an improved kind used for dressing certain tissues by means of little mallets. The cloth is wound around a roller, to which a rotating and vibrating motion parallel to its axis is given, and while this is done a series of little mallets in juxtaposition beat it. Hitherto the mallets at first used to be put in motion direct by means of a shaft with cams; later on eccentrics were availed of, moving the mallets by means of

springs. According to Mr. Jouffray's patent he uses the "atmospheric hammer" of Chenot, already in use in rolling mills. The mallets themselves remain the same as heretofore, but instead of using to move them either cams or eccentrics, they form a series of atmospheric hammers in juxtaposition.

No. 24.—*Calendering Machines for Silk Finishing.*

Perhaps the name of Mr. J. De Beauvais is known to most of our readers engaged in the silk industry, as this gentleman has been identified with the invention and manufacturing of calendering and watering machines for silk finishing for over a quarter of a century. Some of the most valuable and best attachments, etc., have been invented and practically adapted to silk machinery by the aforesaid gentleman. Not only has he given the matter of silk machinery, and particularly those mentioned above, close study, but he has also given much attention to other utensils and machinery, used in almost all branches of the textile industry. Mr. J. De Beauvais is a practical machinist of high standing, and the original maker of the now so celebrated calendering machine, used by almost all the prominent houses.

These machines are of simple construction, and can be produced at a very reasonable price. The best class of repairing and fine work is also done by this house, whose principal place is at the corner of Centre and Howard Streets, N. Y., where some of the most skilful laborers are engaged.

No. 25.—*Yarn with Fancy Curls.*

This is one of the irregular fancy yarns which has been so much in favor during the last few years, and consists of a central thread, forming, so to speak, the core, and a succession of curls of another thread laid on it. This yarn is produced on any spinning machine and in any textile fibre by spinning the central thread in the usual manner, and adding the curls on the way from the rollers to the spindles. The yarn which is to form the curls is delivered by another set of rollers which run at a greater speed, and as they thus deliver a greater length of yarn, this is deposited on the central thread at irregular intervals in the shape of curls or ringlets; another thread is then used to attach them to the central

thread, which is twisted with the whole, so that the central thread, the curls and the binding thread form one firmly twisted thread. Instead of one thread to form the curls, two or more may be used, and these may be of different colors so as to produce a shady effect; in fact, some of the combinations thus formed have all the appearance of a chenille thread. The idea of this arrangement comes from France, and a sample of such yarn, which we lately saw, appeared quite a novelty in this market. This description of yarn has been made in Bradford, England.

No. 26.—*Velvet Nap on Woollen.*

To produce this on woollen cloth without beating, the cloth is first slightly raised in a moderately moist state. After the drying it is raised two or three times against the nap, and once with the nap, in order to raise the fibres. This raising must be modified according to the condition of the cloth. It is then slowly cropped on a longitudinal machine, the nap being raised by a wire brush, no other brush being used in the machine. The delivery rollers must also be altered, by removing the upper one, and covering the lower one with filleting, so that the nap does not get crushed.—*English Textile Manufacturer.*

SECTION XIII.

SOME ANILINE AND OTHER NEW DYE WARES AND PROCESSES, ETC.

No. 1.—*The Value of Bichromate of Potash.*

(For brevity generally called chrome.)

THE introduction of chrome, so-called, in dyeing has been a great boon to the dyer. It is a mordant of itself, but is for many colors best used in combination with some of the other salts, such as alum, bluestone, argol, etc., which, especially in the case of black and blue, prevents them from turning green.

Much more chrome is very often used than is actually required, as may be seen from the following examples: With 30 per cent. logwood $\frac{1}{2}$ per cent. gives a blue gray, 1 per cent. a blue, $1\frac{1}{2}$ per cent. deeper blue, 2 per cent. a lighter blue, 4 per cent. a dull light blue, 6 per cent. a blue gray, 10 per cent. a red gray.

Thus it will be seen that $1\frac{1}{2}$ to 30 per cent. gives the best results, provided of course that the logwood is of full strength, as an excess destroys its color, and it is a fact that logwood will not often take on after an excess of chrome in the mordanting. (How to cure, see page 120.) Although bichromate requires commonly for its use with logwood the presence of an acid, this is not necessary when a salt of copper is used in conjunction with the chrome.

When chromic acid is set free by an acid or acid salt, the chromic acid oxidizes the coloring matter of the woods, which then unites with the chromic acid formed, yielding a colored compound. If there is added a salt of copper, as bluestone, there are then formed by double decomposition bichromate of copper, free chromic acid and sulphate of potash. This last has no real value; on the contrary, the free chromic acid acts in contact with the wood-coloring matter, developing the same.

No. 2.—*Glycerine in Weaving, Printing, and Dyeing.*

In weaving with it the bad smell is avoided, also brittleness in warm weather or from open windows, and it prevents the warps turning mouldy or forming spots through fermentation.

The following recipe will give satisfaction for sizing: 11 pounds dextrine, 26 pounds glycerine at 28° B., 2 pound 3 ounces alum, 6½ gallons of water.

For woollen printing it is useful, as it keeps in a damp state previous to steaming.

For cotton printing it is useful because it increases the oxidation of the mordant before the color is dyed.

For dissolving aniline colors, to 1 part of aniline add 3 parts of alcohol upon the dry color, and 1 part of glycerine 28° B.; on thickening with albumen and other analogous bodies the glycerine opposes the precipitation of the aniline, and is the best agent for keeping it in perfect solution. To preserve sizes, finishings, colors, or mordants, 1 part of glycerine to 20 may be added. Except for very delicate shades of either printing or dyeing, the pale brown glycerine is just as good. If pure it will not change litmus paper. If lime is present it can be detected by mixing in a test-glass equal parts of glycerine and water, then adding a few drops of oxalate of ammonia, on which a white turbidity would be seen if lime is present.

As a lubricator it has no equal, as nothing affects it, and it does not affect the bearings, as many of the nostrums do.

After writing the above, the following fell into my hands, and as it so fully accords with my article I reproduce it here.

THE USE OF GLYCERINE IN DYEING, PRINTING, AND FINISHING.¹

Although glycerine has for a long time been a valuable article in many branches of industry, there are many who are afraid of using it in dyeing or printing, or at least they do not know yet its usefulness.

Glycerine has a special importance in the tanning and treating

¹ By M. H. Herrberger.

of hides, as it helps to keep up the original weight, and prevents them from getting brittle and rancid. The skins, after being slightly tanned, are put for twenty-four hours into glycerine, which has been diluted with the same quantity of water, showing about 15° B., and then dried. The glycerine has no less importance for woven fabrics, as they never get a bad odor, and the weaver can in dry weather work without the least danger of having the warp become too dry, thus causing its breaking. The addition of glycerine prevents the warp from getting mouldy, thus preventing stains. The following is a valuable recipe: gum dextrine 5 kilos. (11 lbs.), glycerine, 28° B., 12 kilos. (26.4 lbs.), sulphate of alumina 1 kilo. (2.2 lbs.), water 30 litres (7.92 gals.).

Glycerine also assists in dissolving anilines and other colors, and makes them able to be kept for a long time; the mixture of albumen, caseine, and gum solutions, used for dressing, keeps in a sound state because it is a preventive from decaying.

It is also very advantageous for printing on wool, as it preserves the printed colors, before steaming, in a constant state of moisture. For cotton prints it is useful in hastening and completing oxidation.

If anilines are dissolved in water containing one-third glycerine, at 25° B., the latter will prevent the aniline from precipitation when mixing with albumen or similar substances, wherefore it is the best agent for mixing two products.

Generally 48 gr. (1.68 oz.) glycerine can be used per litre (21 pints) in dissolving starch, gum colors, mordants, etc. The glycerine used for this purpose need not be white—it will do the same service if it is a clear yellow, in which state it can be purchased at less price. For a few delicate colors only the pure article ought to be preferred.

The glycerine to be used should be from 25° to 28° B., free of acid, alkali, lime, etc. Lime is easily detected by diluting with water, and adding a few drops of oxalic acid solution.

Glycerine is not very often adulterated, although grape sugar and common syrup have been found in it.

For the information of those who do not know the market for a genuine article, I may say I have purchased excellent white and brown from Otto Hann, 1 Cedar St., N. Y.

No. 3.—*Dark Shades of Aniline Colors; How to Make them.*

Many dyers are too much engaged to be able to devote much, if any, time to experiment, and therefore require everything ready at hand. For this reason I engage to match and furnish all aniline colors to shade (see advertisement page). On the other hand, some prefer to make their own off shades. To such I will therefore give some general instructions to guide them.

For wool and silk take by preference the colors that will work with acid, and find out by experiment those that will blend, by which I mean, those that when dissolved together neither precipitate, rise as scum, separate in particles, nor by a reaction reproduce the tar from which they were made. As illustrations I will subjoin a few examples of colors that blend: cardinal and fast red is made with azo-scarlet and acid magenta; darker shades are made by adding acid claret, or they are made by adding equal parts of orange and magenta, or by varying them redder or bluer shades. Maroon, garnet, sultan red, etc., are gotten in the same way, by letting the acid orange predominate, according to the yellow cast desired.

No. 4.—*Salmon by Azo-Scarlet and Orange.*

Drab, by induline and acid brown, if on the red shade, add scarlet or acid magenta.

No. 5.—*Indigo Blue Shade.*

Induline, and for more bloom, add 1 part B. Nicholson blue or serge blue to 3 parts of the induline. About 10 pounds of induline, worked with sulphuric acid, will dye 100 pounds a good fast indigo shade, that will stand fulling and exposure.

No. 6.—*Gold Color.*

Acid yellow 72 parts, acid brown 4 parts, acid green 1 part, and vary to shade.

No. 7.—*Yellow Bronze.*

By lessening according to shade, the acid yellow, otherwise as gold color.

No. 8.—*Dark Bronze.*

About equal parts of acid brown and acid green.

No. 9.—*Fiery Bronze.*

2 parts acid green, 2 parts acid brown, and 1 part acid orange.

No. 10.—*Very Dark Bronze or Olive.*

Add induline or serge blue, or, if preferred, indigo extract to the dark bronze.

No. 11.—*Brown.*

Orange and induline.

No. 12.—*Red Brown.*

Orange, induline, and claret.

No. 13.—*Dark Brown.*

Orange and serge blue.

No. 14.—*Fulling Brown.*

The best for this purpose is made with red shade of fast orange and induline, say 1 of orange to 6 or 8 of induline worked on with an acid and boiled in about 2 hours.

No. 15.—*Dark Colors on Cotton or Mixed Goods by Aniline.*

While the foregoing dyes are recommended, because they are acid colors, for silk and wool, just the opposite are recommended for cotton or mixed goods, namely, neutral anilines; that is, colors that will take on wool without a mordant, and that an acid would be of a destroying nature to, such as methyl violet, malachite green, Bismarck, brown, etc., many of which will blend. I will give a few examples.

No. 16.—*Fine Blue Demi-Fast.*

Mix green with 4 B. violet, proportion to be varied according to strength of green used, and the redness of shade required.

No. 17.—*Puce.*

4 B. violet with about 10 per cent. brown, and 10 per cent. green.

No. 18.—*Plum.*

4 B. violet, 20 per cent. brown, 20 per cent. green.

No. 19.—*Claret.*

3 per cent. magenta, 1 per cent. violet.

No. 20.—*Maroon.*

3 per cent. magenta, 1 per cent. brown.

No. 21.—*Bronze.*

Bismarck and green to shade.

No. 22.—*Scarlet.*

Saffronine and crysodine to shade.

All the above require but little preparation for the cotton, with the exception of the scarlet. From one to two pounds of aniline mordant to 100 of goods will suffice for cotton or mixed goods, when the latter will then take up the color so as to be a match both in the cotton and wool. As an example, see patterns, pages 150 to 169.

All of them will dye on silk or wool, but are more likely to smut than the acid colors are.

No. 23.—*Coal Tar Colors; How to Choose and Mix.*

As I have already pointed out, care should be taken when mixing colors for off shades to choose the colors that will agree, as also mordant, as what suits one does not the other kind; as for example, if azo and resorcine colors are used together on wool it is necessary to use alum; if azo colors are used alone Glauber's salt and sulphuric acid are all that are required, although some desire to use muriatic acid, tartar, etc., as per some of my recipes to meet their case. If for a mixture of azo and resorcine, sulphuric acid was used, the same would be spoilt. For the same

reason resorcine colors cannot be used with acid magenta; acid colors are seldom used in conjunction with the others. The azo colors are ponceau, orange, scarlet, fast red, etc. The resorcine colors are eosine, erythrosine, rose bengale, scarlet, etc.; when desired to use the two kinds together acetic acid should be used.

No. 24.—*First Coal Tar Color.*

It is generally thought that mauve and magenta were the first colors discovered, but that yellow was the first I am fully convinced, as the following will prove. Dr. F. Crace Calvert more than thirty years ago wrote the following to the *Manchester Guardian* (England), which was published at that time.

“I hope to render a service to the numerous dyers of this neighborhood by giving a cheap process for obtaining fast golden yellows.

“This consists in putting into a large earthenware vessel a sufficient quantity of nitric acid of from specific gravity 1.30 to 1.40, or of about from 70° to 80° Tw., to fill one-third part, and then adding coal or wood tar in small proportion. When coal tar is used the acid should be gently heated, either by the direct action of fire, or by the vessel being placed in boiling water; but when the chemical action of the tar has commenced, the heat must be withdrawn until near the end of the operation. But when wood tar is employed no heat is required to facilitate the chemical action at the commencement of the process, but only at the end. When the nitric acid is nearly decomposed, and has transformed as many products of the tar as it is able into nitro-picric or carbonic acid, the liquor is removed, and the remainder of the tar which has undergone no change is then well washed several times with boiling water, and the liquors therefrom are added to the first; the whole is then filtered or allowed to settle.

“In dyeing with this liquor no mordant is required, it being only necessary to dip the silk into a very weak solution to which is added $\frac{1}{100}$ part of sulphuric acid. The depth of shade depends more upon the length of time the silk is allowed to remain in than the strength of the liquor; 100 grains will dye 2 pounds of silk.”

This process, but much more complicated, was communicated, says Mr. Calvert, by a French silk dyer of Lyons; the date of publication was July 17th, 1851.

I may add that shortly after this time I had a sample of the above in a paste form, as then made for sale.

No. 25.—*New Dyes.*

The Germans seem to be the only people just now who are discovering and manufacturing new coloring matters. The chemists of other nations are apparently satisfied with their past laurels.

Two new coloring matters have lately appeared in the market, viz., neutral red and neutral violet, dyestuffs which were discovered by Dr. Otto N. Witt, and are now manufactured by a German firm. The new products are stated to be capable of being used with advantage both in dyeing and printing, the methods of employment being the same as the other aniline colors—that is, fixation by means of tannic acid.

J. F. Espenschied has taken a patent in Germany for the production of violet, blue, and green dyestuffs by means of the trichloride of methyl-sulphochloride, which is used for the oxidation of leuco bases. Methyl-diphenylamine gives a greenish-blue coloring matter, soluble in spirit, which is rendered soluble in water by treatment with concentrated sulphuric acid. The new product dyes wool and silk of a greenish-blue shade. By using the benzyl-diphenylamine, green coloring matters are obtained, soluble in spirit; while diphenylamine and dimethylaniline give violet substances. Of all these products only the coloring matter obtained with dimethylaniline is soluble in water. All the others are soluble in spirit, but can be made soluble in water by treatment with sulphuric acid.

A process for a new yellow coloring matter has been patented in Germany by a well-known firm, Farbwerke Höchst. It is a nitro-derivate of naphthal, the tetranitro compound which forms metallic salts capable of being used as coloring substances.

Bindshedler and Busch obtain coloring matters by the action of the halogens on the nitro-derivatives of resorcine. The resorcine is nitrated directly by means of free nitrous acid, or the compound of resorcine with soda is treated with nitrate of amyl. Nitro-resorcine separates, and when dry is mixed with a solution of resorcine in sulphuric acid, and the whole heated to 100° C. (212° F.). By adding water, the product of the reaction is precipitated. By

means of the nitro-derivatives in solution, brominated compounds are obtained. The coloring matter is precipitated with an acid, and then transformed into a soda or potash salt. By reacting with bromine on azo-resorcine, a blue fluorescent coloring matter is obtained.

Wilhelm Majert obtains a blue coloring substance by the action of sulphide of carbon on the nitroso-dimethylaniline. By oxidation of the product of the above reaction, a blue dyestuff is precipitated, by the addition of zinc chloride and common salt, while a red substance remains in solution. This if reduced with zinc and muriatic acid gives a further quantity of the blue coloring matter when oxidized.

The Badische Aniline and Soda Fabrik has patented a process for the transformation of naphthal in monoamines by means of ammonia, or substituted ammonia. Naphthylamine can be prepared by this method, and other allied substances can also be manufactured in the same way.

A new dyewood, called Beth-a-bara, is said to be imported into America from West Africa. It is very heavy, and is in appearance very much like the dark walnut tree. The coloring matter is found in the interstices between the woody fibres. It is a yellow crystalline powder, and is very similar to the chrysophanic acid of the araroba wood.

No. 26.—*New Colors for Printing Tissues.*

Mr. A. Tomsone furnishes to the *Textile de Lyon* some valuable notes on new colors in paste, recently adopted for printing tissues, from which we translate the ensuing:

“For a year or two past certain special colors admirably suited to the printing of tissues have made their appearance in the English market. These colors have been eagerly adopted by industry. Most of them are steam blue, products more or less fast, ranging from indigo blue to the lightest blue with a greenish cast, and on prints, the latter in particular, produces very lively colors. The indigo blue shade was last year introduced by two Basle firms, and subsequently it was manufactured by a Belgian concern. It is a special preparation, not belonging to the class of artificial colors. In other words, it is not a derivative from aniline. Last

year it has been extensively consumed in consequence of fashion then calling for prints bearing white or colored designs on indigo blue and other dark ground. The tints obtained by means of this product in printing imitate remarkably well dark indigo blue, and at the same time can stand very well the washing with soap. They may also be modified, either by adding to them methyl violet or methylene green or blue, thus furnishing a great variety of either violet, green, or blue shades, according to the aniline color used. The application of the blue is most simple; all that is required is to mix it with acetic acid and acetate of chromium, and then thicken it sufficiently for printing purposes, when, after evaporation, the indigo color is developed. The writer has tried to use this color for the dyeing of cotton cloth and twist. A mixture is made of this indigo blue with common acetic acid and acetate of chromium, diluted with a certain amount of water, and into this bath the cotton is immersed till it has completely imbibed the dye, when the excess of color is removed; it is then dried and steamed. This process cannot be much recommended for twist, but may render some service in dyeing cotton in the cloth. Indigo bronze colors are easily obtainable by passing the goods, after they are dyed as mentioned, between two cylinders, so as to express the excess of liquor, which drops into the bath, and on drying on the cylinder the bronze colors are developed by evaporation. A still better method is to dye them with Laval cutch first and then indigo blue. Colors thus obtained are fast, and there clings to them in fact only one defect, *i. e.*, that on applying nitric acid they do not react the same as genuine indigo.

“As regards the remaining blue colors in paste, one which has become very popular has a greenish cast and produces on prints most magnificent effects, also resisting very well the soap bath. This product has been introduced by various firms under a variety of names. It has been sold in the shape of a thick liquid, and also as paste; it is an aniline derivative, for it contains tryphenyl rosaline. In order to use it for industrial purposes the paste is printed either with the acid of tannin and acetic acid, the color being fixed by evaporation and by passing through emetic tartar, as is generally done with aniline colors, or with the aid of arsenious acid dissolved in glycerine, and at the same time with the aid of a

concentrated solution of acetate of alumina; the color is also fixed in the latter event by evaporation, when the tints obtained will prove to be handsomer than those produced by means of the tannin method. An English firm furnishes printers a paste which has only to be thickened a little with starch paste, the starch having been boiled with acetate of alumina, and the color also fixed by evaporation. This will produce handsome shades not affected by washing them with soap.

“A similar substance has been introduced producing a blue color with a reddish cast, and it has been used for industrial purposes, though not as extensively. There are, besides, other blue preparations for printing prints, but although the colors they give are most magnificent, they are not proof against soap washing, which does not prevent their extensive use in all cases where fast color is of secondary consideration.

“All that now remains to be alluded to are two colors, the one ceruleine and the other galleine. The former is a greenish olive coloring matter, while the second is of a flea-brown color in printing. Although ceruleine does good service in the printing of cotton cloth, it has not been used to any very great extent at Manchester, since it has not proved quite fast under the influence of the sunlight, and it is, besides, rather too expensive when compared with olive color obtained by means of dyewood extracts.

“It has furthermore been attempted, without success, to introduce for industrial purposes blue colors for printing which were in reality nothing but mixtures of violet and methyl green or malachite, but printers have soon discovered that they can make similar mixtures themselves at less expense.”

No. 27.—*Viridine*.

The firm of Brook, Simpson & Spiller exhibited at Paris, in 1878, a green color under the name of viridine. For its preparation they proceed as follows: Diphenylamine is mixed with one and a half times its weight of benzylchloride. The mixture is heated in a flask with a cohobater as long as muriatic acid is given off; the excess of benzylchloride is distilled off, and the thick oily matter remaining is heated for several hours on the water bath with muriatic acid and arsenic acid. A dark green melt is formed,

which is carefully washed with water. When cold, the mass is brittle; it is finely ground, dried, and repeatedly extracted with benzol or toluol. In the residue, the muriate of the new base is found as a bronze-colored powder. By treatment with alcohol, benzol, and caustic alkali the muriate is converted into the free base. If water is added to its solution in benzol, it is separated as a stratum of deep reddish-brown color. The watery stratum is removed and muriatic acid gas is passed into the benzol solution. The muriate thus separated forms a bronze-colored powder in microscopic crystals. The new green color is distinguished by the readiness with which it forms sulpho-acids. If the muriate is treated in the cold with sulphuric acid, there is immediately formed a sulpho-acid soluble in caustic alkalies, but insoluble in water. In this state it can be used for dyeing wool and silk exactly in the same manner as "Nicholson blue." Hence the color is frequently named "alkali green," because dyed in an alkaline liquid.—Report of the German Chemical Society.

No. 28.—*Waste of Wool in Dyeing.*

Manufacturers have complained of losses in amount of yarn supplied to dyers, and in England the subject has given rise to lawsuits. The facts involving technical testimony, the cases were put into the hands of experts as an examining commission to report upon the weights of wool sent by other dyers for three years.

Accordingly this commission examined 282 lots, 123 of which had been dyed by defendants, and the remainder by seven other dyers. The results of this investigation varied from one to four and three-quarters per cent. of loss in dyeing. This divergency was accounted for, not by negligence or carelessness on the part of the dyer, but rather from the beating, teasing, and sorting of the wool, as well as in the dyeing and drying of it, all or each of which operations were performed with more or less care; and that in the various lots there might naturally be a difference between each. On this testimony of the experts judgment was given in favor of the dyers.

No. 29.—*Red, Violet, and Green Dyes.*

The manufacture of red, violet, and green dyes by treating aromatic amines with chlorpikrine is described by the *Politechnische Zeitung* as follows: Aniline and homogenes are heated with chlorpikrine at 110° to 120° C. (230° to 248° F.) for some time, by which action dyes are produced which give, by dissolving in water, *red*, and with alcohol, *violet* solutions. The part soluble in water is precipitated with common salt; the insoluble part is transformed into sulphuric acid. Instead of bases, other salts can be employed; the reaction can also take place in presence of metallic salts. If a mixture of dimethylaniline and benzaldehyd is heated with chlorpikrine, violet and green dyes are produced, which can be separated by fractional precipitation from the acetic acid solution.

Recipes are given with the following proportions: 60 parts aniline and 15 parts chlorpikrine; or, 70 parts dimethylaniline, 20 parts benzaldehyd, and 30 parts chlorpikrine.

No. 30.—*Dyeing with New Colors, Orange, Ponceau, and Bordeaux Colors by means of Azoconjugated Dyes (Couleurs Azoconjuguées).*

Since the newly invented azoconjugated coloring matter (couleurs azoconjuguées) has been introduced, now manufactured almost as extensively as aniline and resorcine dyes in certain quarters of Germany, the use of cochineal, cudbear, etc., for dyeing tissues made of animal fibre, etc., has decreased very materially.

In point of fast color these new chemical productions stand about midway between aniline dyes and artificial alizarine. On comparing them with the natural color which they are able to replace, they offer great advantages, but at the same time there cling to them certain defects inseparable from their very essence. One of the principal drawbacks is the difficulty of dyeing with them a tissue so as to be all of one color. Their advantages are beauty, the great quality that they are fast colors, and finally their extreme cheapness.

These colors are acids which dye animal fibre without mordanting, but without brilliancy. The product, as to be met with in trade, is usually the soda salt of these acids, easily displaced by

mineral acids, such as sulphuric acid, hydrochloric acid, etc. But this displacement is not easily effected with respect to certain products, like for example orange, ponceau, and others, and the result is that these latter dye with greater ease. As for the coloring matter, which is easily displaced, and therefore dyes unequally, the difficulty is circumvented, and it is suggested to let the dissolution of the color take place at the bottom of the coloring bath by means of a tube which is introduced to that effect. By rapid and incessant manipulation very good results are reached in this manner.

The same, as is the case with cochineal, the dyeing with tin mordant produces good results; the color does not fade, but it is not a full one. Acetate of alumina, with or without a mixture of acetate of lead, produces lively tints, but too light ones are liable to turn out dirty. By combining the two we shall obtain satisfactory results answering all requirements. The part which the tin performs in this combination is not precisely known, and it is all the more difficult to explain, since on cotton twist the same results are reached by means of basic sulphate of alumina alone. The dyeing of jute is done the same as that of cotton.

To apply this coloring matter requires the same dexterous management and care as is necessary with cochineal; it is consequently of the utmost importance to indicate to dyers a method how to handle the same.

A good result cannot be had unless we form on the fibre a chemical combination between the base of the mordant employed and the coloring acid.

The mordants employed are the salts of alumina, of lead, of chromium and of tin. The first easily fixes the color, but produces lakes without beauty; it cannot therefore be used except for printing cotton or the preparing of lakes. The only tin composition used is the one obtained by dissolving this metal in aqua regia, and not the one obtained by oxidizing the tin salt through the intervention of nitric acid. Bichloride of tin and ammonia, the same as stannate of soda, may be used, but they offer no advantages for dyeing wool and only for carded cotton. The salts of chromium may present some advantages for shading Bordeaux color,

but the most important are the salts of alumina, which produce with acid coloring matter, the purest and most brilliant lakes.

For the dyeing of wool, alumina mordants are frequently applied to no purpose, in consequence of the acidity of the bath, for alum and sulphate of alumina operate as free acids; it is true they set free the coloring acid, but they keep it in a state of solution and prevent it from fixing. It is consequently imperative to neutralize at least a portion of the acids of alumina mordants through the intervention of an alkali. The same case occurs with the acid mordants of tin.

This neutralizing effect is obtained by allowing the wool first to be boiled with a little cream of tartar, which causes to be precipitated on the fibre the basic salts of alumina, while the acid made free remains in the bath. The dyeing is then done in another bath which may be exhausted to the bottom.

Since however the dyeing in two consecutive baths is altogether too complicated, and at the same time too expensive a process, we add to the bath prepared for dyeing, basic sulphate of alumina or rather this salt is produced in the bath by a sufficient addition to it of soda. Add six per cent. of alum to the weight of the wool and two per cent. of soda, and the results will be all you can wish for. Phosphate of soda instead of soda is, however, still more advantageous. This salt and the arseniate of soda have been used for a long time past in printing tissues.

The due proportion of water is of the greatest importance in dyeing with this coloring matter. The most suitable proportion for allowing the exhaustion of the bath, with as little mordant as possible, is about thirty litres of water to one kilo of tissue.

THE DYEING OF WOOL IN THE PIECE.

A uniform color is, in this instance, more difficult to be obtained than is the case with wool in the hair. Felt is the most difficult to dye uniformly; it is therefore advisable to commence cold and raise the temperature gradually and even slower than would be necessary with cloth. Woollen yarn is treated the same as wool in the piece. The approximate weight of the coloring matter to be used for wool dyeing fluctuates according to the depth of color to be imparted. For scarlet and light amaranth one or two per

cent. are requisite, and as much as three per cent. for deep amaranth, and five per cent. and upward for reddish-brown shades. A deep scarlet requires one and a half per cent of Ponceau R.; a bluish-red, one and a half per cent. of Ponceau R. R. R. (R. in Ponceau is the same shade as B. in other scarlets.) A full red is had by using two and a half per cent. of Ponceau R. and two and a half per cent of Bordeaux R. A pure Bordeaux wants three grains Bordeaux B. A very dark fast brown is obtained by applying ten per cent. of coloring matter. It should be remarked that one per cent. Bordeaux possesses the same amount of coloring strength as fifty per cent. cudbear paste, and is at the same time as fast as madder.

The use of phosphate of soda in the presence of tin and alumina mordants, while enabling us to dye precisely all of a uniform color, communicates to the latter great beauty and the greatest intensity.

Following is the recipe for it: The object to be dyed is first moistened and then four per cent. of phosphate of soda dissolved (4 per cent. of the weight of the wool), together with the coloring matter in a tub of water 30 to 35 degrees C. (86 to 95 degrees F.). The tissue is immersed and stirred in it for ten minutes, when it is removed. There is then added to the bath six per cent. of alum in solution; it is thoroughly stirred, and the cloth is again steeped in it and worked for a quarter of an hour. Take it out again and add two to four per cent. alum, put it in once more and stir the whole for a quarter of an hour, then raise the temperature by degrees by means of steam so as to cause the bath to boil in about half an hour. According to the nature of the article to be dyed, it is removed just when the bath commences to boil, or it is left to stay in it for ten to fifteen minutes. If too much water be used there will be required proportionately more alum; the minimum of the latter is the double of the phosphate of soda. In order to insure a complete success it will be necessary to observe closely the indicated temperature, and only heat slowly. A strong addition of alum all at a time and a rapid heating up to a boiling point will produce nothing but a superficial coloring.

No. 31.—*Dyeing Cotton.*

The inventor proposes the dyeing of cotton before spinning, *i. e.*, in that state of work where the cotton leaves the machine in the form of an endless ribbon (slubbing), whose single fibres lie loose and parallel beside each other, and not being in any way felted, doubled or twisted. The dyeing process takes place during spinning, or is, in a sense, impercolated, but without interrupting it in any manner. The cotton is led into the dye bath in a manner which makes the fibre always retain a stretched state, in order to avoid any filling or twisting.

The dark fibre is then brought to the second and third carding machines. It is important, however, to observe that the machines, dye vats, and wash bath are so arranged that the fibre is always stretched to avoid felting.

No. 32.—*Decorative Effects on Figured and Knit Tissues.*

It is well known that the above species of goods are made on Jacquard looms, but it is highly onerous to employ so many colors together, for the tissue thus ornamented is liable to show but poor colors, and it is besides very expensive. M. Imbs, by applying dyeing and printing, has endeavored to produce new decorative designs economically. In doing so it was impossible to use washed colors, for the primitive dyes of the tissue would have been spoiled by the washing and evaporation, together with colors not washed, and the tissue would have lacked brilliancy. The inventor therefore uses brilliant powders fixed on the tissue by means of some binding substance, preference being given by him to silicate of soda mixed with glycerine (examine his patent of Sept. 13, 1880). The effects thus added to the designs produce a very handsomely ornamented tissue of the utmost brilliancy and capriciousness.

No. 33.—*Practical Examination of Aniline Colors.*

In order to find out if aniline colors are a mixture of different substances I recommend the following method, which can be done by every practical person. The apparatus necessary for this purpose consists only of two panes of glass, which, however, have to

be cleaned and polished very carefully. Some of the color is put on the larger plate, and thrown off again; some very small amount will always adhere to the glass, the second pane is put on the first one, and a few drops of water let fall on the larger pane and moving the second one over to the water. By inclining the two plates in the proper manner the water will generally reach the color and show the shade of every particle which is distributed on the glass at different places. Thus the difference of shades of the mixture can be seen immediately. Alcohol can be used also, but one or two drops are sufficient to show the result.

J. Spiller recommends the use of concentrated sulphuric acid, which even in small quantities furnishes characteristic reactions with many of these dyes. For instance, sulphuric acid is colored by Magdala (naphthaline red), blue black.

Safranine (grass green), indigo blue, when strongly heated.

Chrysoidine, deep orange, almost scarlet when heated.

Alizarine, ruby red and dark red brown.

Eosine, gold yellow.

Naphthaline yellow, dissolves with difficulty, yellow, discolours when heated.

Chrysaniline, yellow and brown, noticeably florescent.

Auvine, yellowish-brown, not florescent.

Satin orange, rose red, scarlet when heated.

Satin scarlet, scarlet, very firm when heated.

Biebrich scarlet R, blue black and deep purple.

Biebrich scarlet B, blue green.

Aniline scarlet, gold yellow, very firm when heated.

Induline, slate blue to indigo.

Rose aniline and violet aniline, yellow and brownish-yellow.

Phenyl blue and diphenylamine blue, dark brown.

Iodide green and malachite green, light yellow; iodide develops upon heating.

Citronine, light cinnamon.

Concentrated muriatic acid also serves to distinguish the dyes; thus for instance, safranine gives a violet solution, while Biebrich scarlet is precipitated as a red cottony powder.

No. 34.—*Washing and Rinsing Wool.*

The wool is thrown into a hopper and fed therefrom by a number of rods or staves which are armed with spikes and have an up and down vibrating motion. The spikes are set at such an angle that they hold the wool while ascending, but release it when they return. The layer of wool is dressed off to a definite thickness by a vibrating beater or doctor, and is thrown forward into a tank by a rotating brush. The washed wool is pushed forward by racks of rotating and reciprocating staves, by which it is carried to the squeezing rollers, the lower of which is partly immersed in the liquor. A beater then takes the wool from the squeezing rollers.

No. 35.—*Dyeing Woollen Yarns.*

For producing "tie and dye" yarns in which a variegated effect is obtained by retaining the natural color of the yarn for a part of the hank, the inventor makes the hanks into a rope or chain by looping them together by a chain stitch. Where the loop or knot comes, the dye cannot penetrate and the hank is not colored.

No. 36.—*Method of Dyeing Yarn in Skeins, Rainbow-like.*

The printing plate, which is covered with heavy cloth, is fastened by hinges on a table. The cloth is covered with various colors by means of a brush. Then the yarn is spread on and the printing plate bent down, and by means of a lever pressed on the table, by which action the printing is finished. This method allows of carrying the colors on to the cloth which covers the printing plate, directly on the goods, and does away with the block which has been so far used. The printing is done easier and more completely, allowing the color not only to cover one side of the yarn, but on account of the soft surface of the printing plate, the whole surface of the yarn is covered. The changes from one color to the other are also more gradual, and give a better appearance than those obtained by the old method.—*D. A. Polytechn. Zeitung.*

No. 37.—*A New Aniline Dye.*

A new dye of Paris invention, called *Bleu Florissant* (blooming blue) has just been imported by the house of Herman Simon, the

extensive gros grain silk manufacturers of Union Hill, N. J. It is most delicate, and exhibits a greater variety of tints and shades than have ever before been shown by a single dye. It is brilliant and changeful by day or gas light.

No. 38.—*A Blue Dye.*

W. Magert, of Elberfeld, dissolves 15 parts nitro-sodi-methyl aniline in 40 parts muriatic acid and 200 parts water, and adds a 10 per cent. solution of a sulpho-carbonate, till the liquid, which takes a transitory rose color, has become colorless again. He adds then 1 part zinc chloride, 100 parts common salt and an oxidizing agent till a blue precipitate ceases to be formed. The red solution is then reduced by zinc and muriatic acid, and on adding a further quantity of an oxidizing agent, a blue color is again deposited.—*Chemiker Zeitung.*

No. 39.—*Wool Dyeing.*

Mr. Gautier Florian has patented, in France, the following process for wool dyeing:—

Red: 1st. The wool is worked for thirty minutes in a solution of one pound of soap, in one gallon of water, at 40° C. (104° F.), the goods are well squeezed, and then dried in a hot stove.

2d. It is worked in a solution of acetate of alumina, at 4° B., to which one half pound of sulphomuriate of tin is added for every one gallon of the acetate of alumina, and dried in a hot stove.

3d. Pass through a solution of silicate of soda, at 48° B. (4 pounds per every 100 gallons of water), at a temperature of 40° C. (104° F.), and to be well washed.

4th. Dyed with alizarine as for cotton, by using 20 pounds alizarine, 10 per cent. for 100 pounds of wool.

Black: Same operations as before, only substituting to the mordant of alumina and tin, as above, pyrolignite of iron, at 6° B. By mixing the alumina, tin and iron mordant in different proportions, shades can be obtained varying from red to orange, gray, violet, etc.

No. 40.—*The Colors of Croissant Bretonniere.*

The colors of croissant and bretonniere give all gray, yellow, and brown shades up to the black brown. It has not been possible hitherto to produce, on this principle, reds, blues, and greens, though some of the shades have a reddish and a lilac reflection. Their property of requiring no mordant is of special importance. They impart additional features to certain fugitive colors, especially to the anilines; they resist acids and acid salts, and are not attacked by hot soda lye, by air, or light. They dissolve readily either in spirit or water, and even in a dilute state, they work on both the animal and vegetable fibres more readily than any other color. Mixed goods of woollen and cotton, silk and cotton, and even those containing linen, can be dyed in one operation, perfectly even and free from uneven appearance, as readily as those consisting of one material. Yarns do not require to be moistened before dyeing.

To produce a fine gray on 10 kilos. (22 lbs.) of cotton yarn, $\frac{1}{4}$ kilo. (0.55 lb.) of color is sufficient, the cost of which is about 14 $\frac{1}{4}$ cents. No additional plant and no novel manipulations are required. The yarn or cloth is entered dry, and worked in the ordinary manner for half an hour; it is then placed in a chrome bath at 80° to 90° C. (176° to 194° F.) and worked for fifteen minutes. It is then taken out, washed in clean water, and passed through a beck of boiling soda lye. Other metallic salts may be used instead of chrome, with a view to modify the tone. Wool and silk must be finally passed through a bath of water containing a little acetic acid to neutralize the soda. For medium shades 80 litres (21 gals.) of water, $\frac{1}{2}$ kilo. (1.1 lb.) of bichrome may be taken for the fixing beck, and 9 litres (2.48 gals.) water and 100 grams (3.5 ozs.) soda for the alkaline beck.

At Mulhouse, a select committee was engaged in investigating these colors. Their remarkable fastness first attracted attention. Thus ink stains can be removed by oxalic acid from cloth dyed with these colors without affecting the dye. The chemists of the committee prepared samples of the colors, and convinced themselves of the certainty and regularity of the process. In dyeing it is not necessary to use hot water, as the colors

dissolve easily in cold water, and attach themselves to the fibre; but it is better in practice to work at 6° C. (42.8° F.). It colors on the fibre very easily, and is not affected by imperfect bleaching or dirtiness of the material.

Sunlight has very little effect on these colors. During the time that the experiments of the committee were continued, no change was produced by either sun or air. Boiling soap lyes have scarcely any action, oxalic acid has no effect, but chlorine discharges them. The opinion of the commissioners was, that the shades of the new colors could indeed be produced by dye wares previously known, but that the former had the advantage in application, in cheapness and fastness.

Printing experiments were made with four colors; first, with color thickened with dextrine and gum tragacanth, and then with a precipitated color. The latter is produced by means of acids. The soda salts are washed out with warm water, and caustic soda is then added, which partly dissolves the colors and makes the fixation perfect. Whichever method is used, the color is chiefly fixed in the very act of printing. The pieces are then steamed, and a passage through the bichromate beck is not necessary. By combining a dyed ground with printed shades, patterns of two or three colors are produced, which are distinguished by great permanence. The printed patterns are very fine, and give the hope of producing by means of these colors certain effects hitherto not obtained by the Jacquard loom.

No. 41.—*Cachou de Laval*.

1 $\frac{3}{4}$ oz. of the color to 2 $\frac{1}{4}$ pints of water gives a very useful shade; to fix, use 75 grains chrome to 2 $\frac{1}{4}$ pints of water.

A bath of 45 grains to 2 $\frac{1}{4}$ pints of water gives, after passage through chrome, a light yellow gray. If 150 grains are mixed with $\frac{3}{4}$ ounce of catechu previously dissolved in 150 grains of caustic soda lye of specific gravity 1.208 and 1 pint of water, and made up to 1 quart with water, or a little over, and cotton worked in for fifteen minutes at 165° F., and then taken through a chrome liquor, it produces a bronze, or deeper if through aqua fortis water 2° B., in place of chrome. The fixing baths much affect the tones. Nitrate of iron gives a yellowish-gray; bluestone a blue-gray, which may be used as a ground for indigo.

No. 42.—*Production of Coloring Matter from Paranitrobenzol.*
O. Fischer (German patent, 16,766).

By the action of muriate of aniline upon paranitrobenzaldehyde there is not formed at once nitrodiamidotriphenylmethan, but by the action of two molecules of aniline upon three molecules of nitrobenzol there is formed an intermediate product, which if boiled for some time with strong acids passes into nitrodiamidotriphenylmethan. The aniline salts behave in a similar manner with other volatile acids. If the salts of the primary aniline bases are used with acids which are not volatile, or only with difficulty, two molecules of aniline, etc., react with one molecule of nitrobenzoyl, and form at once a nitroleuco-base, which can be oxidized either at once or after the reduction of the nitro group.

No. 43.—*New Coloring Matter.*

Prof. Ph. Weselaky, of the Technical High School, in Vienna, has succeeded in preparing a new coloring matter, which, when used on silk, shows a fine blue color by daylight, while it appears of a beautiful rose by artificial light. The solution in alcohol shows a deep violet color by transparent light, while by reflected light the solution is red.

No. 44.—*Remarks on Bleaching.*

For bleaching feathers, hair, silk, ivory, etc., hyperoxide of baryum is more used every day. Lately a Berlin firm brought peroxide of hydrogen into the market, which, after suitably diluting with water, may be directly used for the same purpose.

No. 45.—*Negrotine.*

The following instructions are given for dyeing woollen yarns and pieces with this fantastically named compound. To dye 2 pounds 2 ounces of wool, a cistern is required containing about 11 gallons of water. 1st dye: the water is raised to 122° F., and there are dissolved in it negrotine 17½ ounces, turmeric 4¼ ounces, copperas 7 ounces; when all is dissolved the wool is entered; the water is raised to a boil, which is kept up for three-quarters of an hour; lift, and rinse. 2d dye: when the flot has served for one

lot of goods it is made up with water to the same bulk as before for dyeing 2 pounds 2 ounces wool. It is heated to 122° F. as before, and half the above quantities of wares are put in. The manipulation is the same as before. This second bath may be preserved and re-used with the same addition as before. To find the exact price of dyeing wool in this manner it is necessary to dye three or four successive lots. Negrotine gives a full black, verging upon a blue, which may be modified where necessary by the addition of turmeric. The black is very fast, and never turns green.

No. 46.—*New Fast Colors.*

On the authority of the *Textile de Lyons*, some new coloring matters have been brought into the market which give shades fast against light, air, soap, and acids, varying from mode iron gray, blonde, reddish, blue, smoke, gold, hay green, dull violet, wood, etc., on cotton, silk, and flax, either in hanks or pieces, and also on mixed goods. The coloring matters are soluble in four times their weight of hot water, slightly acidulated with acetic or muriatic acid. The dyeing is said to be done in a single bath, with a little alum, or, in some cases, muriatic or acetic acid.

No. 47.—*Fast Scarlet for Cotton.*

The process for obtaining scarlets on cotton relies on the formation of an azo color on the fibres. The cotton is first impregnated with a solution of naphthol in caustic soda, and then worked into a second bath composed of aniline, nitrate of soda, and muriatic acid, which will form a solution of diazobenzol. In this case an orange color is produced on the fibre; if toludine is used instead of aniline, then an orange of a redder shade is obtained, while, if oxilidine is taken, the shade is a yellow scarlet. Bluer shades of scarlets are obtained using naphthylamine, diazoamidobenzol, etc.

No. 48.—*Aniline Black with the New Oil.*

(For 100 lbs. cotton.)

• Prepare in emulsive oil. Make up a water with muriatic acid 9 pounds, aniline oil 6 pounds, bichromate of potash 12 pounds,

sulphuric acid 8 pounds. Work for an hour, raise quickly to 194° F., soap, oil, and dry.

No. 49.—*Lightfoot's Aniline Black Crystals, Soluble in Alcohol and Water.*

The insoluble black is first prepared from muriate of aniline, chlorate of potash, chlorate of copper, etc. The black precipitate is filtered, well washed, and dried on the water-bath. From 50 parts of aniline there are easily obtained 125 parts of black. This perfectly insoluble product is stirred into two parts (*i. e.*, twice its weight) of aniline oil. The mixture is heated from 356° to 374° F., till the whole becomes soluble in alcohol, which is soon effected. The aniline is now completely neutralized with muriatic acid, and water is added till all the muriate of aniline is dissolved. The black now separates out in a solid shining form, soluble in spirit. An increase of weight is not perceptible. The color can be used in this state, or it can be made soluble in water by means of oil of vitriol. One part of aniline gives 2.5 parts of the color soluble in spirit, or 3 parts soluble in water.

No. 50.—*Improvements in Aniline Black Dyeing on Cotton and other Fibres in a Raw, Spun, or Woven Condition.*

J. G. Jagenburg, of Rydholm, has taken out a German patent for an improved process. He remarks that according to the methods hitherto in use, the goods to be dyed are plunged into a dye-pan containing a salt of aniline, chlorate of potash, and certain oxidizing agents, such as chromate of potash, compounds of vanadium, etc. The acids which are developed upon the fibre during the drying process, and the development of the color, tender and attack the goods more or less, even if the greatest care is employed. If, in order to counteract this injurious action of the acids, neutralizing gases are introduced during the process of oxidation, as has been proposed, this process, which is essential for the formation of the black, is checked and suspended.

If, on the other hand, the process of oxidation in a solution of aniline containing chromate of potash is conducted in the dye-pan itself, either by prolonged action or by the aid of heat, a considerable loss of material is experienced, since the oxidizing agent acts not alone upon the aniline compounds, adhering to the fibre,

but also upon such as are still in solution in the flot. The matter thus precipitated is only combined superficially with the fibre, and on washing and soaping, the greater part of the coloring matter is stripped off and lost.

To prevent these inconveniences, the inventor separates the various processes required for forming the black color, and performs the development in a special oxidation bath, thus effecting that the acids, in consequence of the presence of water, cannot injure the goods, whilst the loss of coloring matter is prevented, and a more intimate combination of the dye and the fibre is insured.

The new process is as follows: The material to be dyed is saturated with a concentrated solution of a salt of aniline (muriate, nitrate, sulphate, or oxalate), and with chlorate of potash or some other chlorate. Instead of a salt of aniline, aniline oil and an acid may be used.

The goods are then pressed to remove any excess of the solution, which may be used again in a future operation. The pressed material is dried in a well-ventilated room, thus effecting an intimate combination between the aniline compounds and the fibre, so that everything is prepared to yield a good black without loss of material.

The dried goods are then entered in an oxidizing bath. After this process is completed the liquid is run off and preserved for future use. The dyed goods are washed and further treated as the case may require.

No. 51.—*A New Class of Coloring Matters.*

The colors in question are blues and violets, and remarkable for their cheapness and fastness. They have received the name Indophenols, and have been patented by the inventors, Koechlin and Witt, of Mülhouse. They are applied in a manner similar to indigo. In order to dye wool, the color is heated to 176° F., along with alkaline water and glucose. The greenish liquid is diluted with more water and the wool is entered. When the shade has been reached, the wool is taken out, nipped between rollers, and spread out in the air, or preferably passed through an oxidizing bath. For printing, the color is thickened with white starch, and receives an addition of soda along with a reducing

agent such as glucose, zinc-powder, hydrosulphite, etc. The cloth is prepared with alizarine oil, and after printing, it is steamed for one and a half to two hours. In this manner indophenol blue can be combined with alizarine reds, aniline blacks, and all steam colors. Professor Noelting, of Mülhouse, believes that these colors will be more dangerous rivals of indigo than Baeyer's artificial indigo.

No. 52.—*The Naphthaline Colors.*

The naphthaline colors belong to the most important inventions of the last years in the chemical branch of colors. The use of cochineal has been decreased considerably by these inventions, and if some time ago, when these new products were not yet perfect enough, it was believed that they never would be able to throw cochineal and its products out of the market, this opinion has now changed. With the better qualities of the naphthaline colors the shades can not only be produced just as bright as those prepared with cochineal, but even surpassing them.

These dyes were first prepared in Hoechst alone, but at present also in Mannheim (Germany). They are of the greatest importance in wool dyeing and especially in cloth dyeing. The goods intended for the east of Europe, for which cochineal was generally used, are now dyed with these colors, wherefore they have become very important for countries as Austria, Bohemia, Poland, Saxony, etc. America also uses at present many naphthaline colors. Cochineal colors show a greater fastness against light, and it is said that naphthaline colors will not stand sunlight as well as is the case with cochineal. Although this is not so exceedingly important, it must be said that naphthaline colors should be preferred to cochineal; because in fulling, the former do not change their shade, although they slightly bleed, while cochineal gets blue, which cannot be repaired again by reviving. Also, against sulphuring, naphthaline colors show great resisting capacity, and they can be produced on the fibre with greater ease.

Glauber's salt or sulphuric acid and alum, with a little tartar, is used as a mordant. In dyeing, it should be especially observed that the necessary sulphuric acid 50° be added, and the goods not boiled too much. If at the end of the dyeing process a little

chloride of tin is added, the brightness of the color can be increased. Alum is not very well liked, as it makes the wool hard, and it is only occasionally added, in order to allow of the adding of other coloring matter (resorcine colors) to the same dye-bath.

For the preparation and dyeing of mixed goods, the naphthaline colors are of great importance, as they dye the same colors and shades on cotton as are produced on wool.

Coccinine, which belongs to the naphthaline group, produces a fine carmoisine, and distinguishes itself by its fulness and its bluish shade. The dyeing has to be done carefully, and especially the addition of sulphuric acid has to be done very gradually; after the boiling, a little more chloride of tin may be added, by which the purity of color is increased. In combination with acid, coccinine produces various cherry shades of moderate fastness. Of the utmost importance is the Bordeaux dye, which is used very much on loose goods, wool, and especially on silk. Lighter shades, produced by this color, are similar to archil. Although archil is easier dyed even, the advantages of Bordeaux dyes consist in the greater fastness and in the easier way of producing certain shades. If the goods are dyed with archil and indigo, the shade can easily be missed, as acid turns yellowish and alkali blue. Bordeaux dyes are not liable to be changed by these influences.

Combined with the greater capacity of resistance against acids and lyes, the Bordeaux colors show a considerably greater fastness against light.

In silk dyeing, naphthaline colors are of the utmost importance on account of the easy manipulation and the brightness of the shades. As they dye with soap and sulphuric acid, all acid colors can be dyed in one bath to produce the greatest variety of shades.

For cotton these naphthaline dyes are also important. They are fastened upon the fibre by soaping, and alumina and tin mordants. If the preparation with the mordants has been done carefully, very fine colors, pretty fast against light, can be produced, which are important for dyeing mixed goods. The Bordeaux colors are not very well fitted for cotton dyeing, as the shades are too expensive, and they can be produced with less cost with other wares.

No. 53.—*Production of Dyes by Electricity.*

Goppelsroeder has invented electric dyeing; he prepares dye stuffs by electric process, and aniline blue and black were exhibited in the Swiss division of the late Paris Electrical Exposition, which were obtained by the electro-chemical method.

If two platinum wires are immersed in slightly acidified water, connected with both the poles of the column, the water is decomposed; oxygen gathers at the positive, hydrogen at the negative pole. Hence follows that electricity may be used for the fabrication of new substances, if chemical stuffs have been dissolved in the water, which, under the influence of oxygen or hydrogen, either become decomposed or combined. Becquerel already has used this method to advantage. Before 1860, Frankland, Kolbe, v. Babo used the hydrogen obtained by the decomposition of water to reduce various organic bodies, for instance, the cinchonine. A. Renard, also, in the last few years, made use of it for his alcohol preparations. Goppelsroeder has, since 1875, with the operation of the electric current, produced certain dyestuffs; he exhibited them at the time before the Société Industrielle de Mühlhouse; at the same time Coquillon originated the indissoluble aniline black by the same process. Goppelsroeder continued his researches, and it must be said that he has brought the electro-chemical method, comparatively speaking, to a high standard.

Dyestuffs used in the industry of to-day, nearly all are produced from coal tar; by a succession of chemical combinations and alterations are produced the long list of those admirable lustrous aniline colors, by simply oxidizing certain substances, reducing others, in other words, removing this oxygen by help of hydrogen. These oxidations and reductions, by Goppelsroeder's method, occur chiefly by electricity.

He immerses organic bodies in acidified water, which with oxygen and hydrogen may change into coloring substances, and then brings the decomposing current into operation. Since, under the operation of the oxygen, one substance is often produced at the same time that another is generated by the influence of hydrogen; the inventor separates both electrodes by means of a porous vase and thus prevents the above secondary reactions. The dyestuffs

generated by oxidation deposit themselves in one vase, and those formed by hydrogen, in the other one.

The substances with which this chemist experimented were chiefly aniline and toluidine salts, and their derivatives; also salts of methylamine, diphenylamine, and methyldiphenylamine, of naphthylamine, and finally, of phenol. He thus has produced: Aniline black, various aniline blues, the Hoffman violet, artificial alizarine, etc.

Aniline black deposits at the positive pole if a hydrated solution of chlorate, sulphate, or nitrate of aniline is slightly acidified with sulphuric acid, and then submitted to the battery.

Aniline blues also deposit at the positive pole by submitting a solution of rose aniline, to which a little methyl-alcohol, a trifle sulphuric acid, and very little iodide of potash have been added, to the operation of the current. The alizarine forms at the negative pole by mixing anthrachinon with a concentrated solution of caustic potash, etc.

Specimens of silk, exhibited at the Electric Chemical Exhibition, Paris, and dyed with colors produced by this electric method, found much favor. They consisted of thirty-six colors, of the most different shadings. Goppelsroeder's method is susceptible of still greater improvement, and we would not be astonished by hearing that all those admirable colors will sooner or later be produced in factories.

No. 54.—*New Bleaching Method.*

A new bleaching procedure for vegetable fibres has been invented in France; it consists of a solution of chloride of lime, into which a stream of carbonic acid is passed. The inventor, M. Cosse, states that the process operates very energetically, shortening the time of bleaching, while it does not attack the fibre.

No. 55.—*Sulphurous Acid for the Bleaching of Silk.*

Mr. Raoul Pictet, of Geneva, is trying to introduce liquid sulphurous acid in the Lyons works for the bleaching of silk. The acid is liquefied according to his patented process, and then dissolved in water. It is well known that the sulphuration of silk has been carried on for a long time in the so-called sulphur cham-

bers, where the silk was exposed to the vapors of burning sulphur. This method, although very economical and effective, has many drawbacks, and therefore it has been repeatedly attempted to abandon it, and employ, instead, sulphurous acid in solution in water, but, however, without the success that was expected. Whether Mr. Pictet will be more successful remains to be seen; but grave doubts are entertained by competent persons as to the efficiency of sulphurous acid in solution.

No. 56.—*New Process of Bleaching Straw and Wool.*

This process, says a French paper, is based on the combined action of a vacuum more or less perfect and of certain gases. The straw is placed in an air-tight apparatus, which is more or less completely exhausted. Then there is introduced into the receiver gaseous chlorine, or oxygenous compounds of chlorine in a gaseous state, or aqueous solutions of these gases, or solutions of their saline compounds, which are afterwards decomposed by an acid. For matters of animal origin, such as wool or fur, instead of chlorine and its compounds, there are used sulphurous acid in a gaseous state, or an aqueous solution of sulphurous acid, or of one of its salts decomposable by an acid. In either case an excess of the re-agent is eliminated by simple exposure to the air, by a current of air driven in, by the effect of a vacuum, or by a combination of these different means. In case of need the acid formed on contact of the fibres is neutralized with ammoniacal gas.

No. 57.—*New Method of Silk Bleaching.*

(MM. Pelangié and Bedu.)

The object of the process is to take away from the silk its natural color, rendering the so-called wild silks so white that they can be dyed in all shades by the ordinary methods. The silk, ungummed as usual, is steeped in a solution of bromine, more or less concentrated according as the color of the silk is more or less tenacious. The duration of the immersion is half an hour. After draining, the silk is steeped in a second bath composed of any acid diluted with water. After about half an hour the silk is taken out of the bath and drained again. It is sometimes necessary to give two or more bromine baths, followed by as many acid baths.

Tartaric and citric acids give the best results, but instead of them may be used carbonate of soda on the alkaline of bisulphates.

No. 58.—*Discharge of Aniline Dyes.*

The best solution for discharging hydrogen is tin salt (protochloride of tin), but it is important that it be of good and pure quality. This solution of tin salt is to be put in an earthenware mug, in which it is to be diluted with water until it stands at about from 1° to 2° B. Then a small quantity of tinfoil is to be added. In this liquor the article which has to be discharged of its color (previously well cleaned from grease, etc.) is to be put. The mug has to be covered and heated in a vessel which contains hot water. From time to time it is necessary to look how far the discharge has taken place, and as soon as it is satisfactory the article is to be taken out and washed in water. For woollen goods it is essential to use warm water. According to Dr. Reimann's experience, it is best to leave the article in the hot tin liquor for about a quarter to half an hour, and to remove it as soon as it is cold. After this time the color is generally all gone, it is not advisable to employ the heat much longer. There are, however, sometimes cases where the tin salt does not completely remove the color. Under these circumstances cyanide of potassium may be employed, but only when absolutely requisite. But as the use of cyanide of potassium for discharging aniline colors has been well known by a great many dyers for some time, and as the same is such a powerful poison that its use is connected with the greatest danger to the working people, notwithstanding all precautions, the use of it is not recommended.

No. 59.—*To Prepare Everlasting Flowers for Dyeing.*

They should be tied up in bunches, and laid in wood or stone vats for three weeks with stone weights upon them to keep them under water. Then take them out and hang them in the sun to dry. They are then ready for the dark colors. Those for light colors should be taken through a weak chloride of lime and dried. They will then be ready for any of the aniline colors.

No. 60.—*Sure Test for Archil.*

The best re-agent for the detection of aniline red is picric acid, in extract of archil diluted with water. It occasions no precipitate, but if aniline red has been added, it gives a strong brown precipitate, the picrate of rosaniline. In this way very small per centages of aniline red or violet may be detected.

If the proportion is very small the precipitate remains suspended for a long time, and the liquid appears almost clear by transmitted light. But by reflected light, the precipitate appears as a turbid brown which does not subside for some days.

No. 61.—*Chaudet's Patent Alizarine Oil.*

It is prepared from castor oil, freed from mucilaginous (gum) matter, and is said to effect a saving of 20 per cent., in comparison with other alizarine oils. The patentee gives the following instructions for its use: For turkey red, add to $1\frac{3}{4}$ pints soda lye, at 2 per cent. Tw., 120 grains of oil. Take the goods through, and repeat after dyeing, the color will be richer by 20 per cent., and the washing entirely prevented. In alizarine dyeing the goods are taken twice, thrice, or even four times through the oil before dyeing, and in order to produce a rose red, a very little stannate of soda is added to the dye beck. For aniline black, the process is as usual.

No. 62.—*Removal of Stains and Spots.*

Acids, Vinegar, Sour Wine, Must, Sour Fruits.—White goods, simple washing, followed up by chlorine water, if a fruit color accompanies the acid. Colored cottons, woollens, and silks are very carefully moistened with dilute ammonia, with the finger end. In case of delicate colors it will be found preferable to make some prepared chalk into a thin paste, with water, and apply it to the spots.

Alizarine Inks.—White goods, tartaric acid; the more concentrated, the older are the spots. On colored cottons and woollens, and on silks, dilute tartaric acid is applied cautiously.

Blood and Albuminoid Matters.—Steeping in luke-warm water. If pepsine or the juice of *carica papaya* can be procured, the spots

are first softened with lukewarm water, and then either of these substances is applied.

Grease.—White goods, wash with soap or alkaline lyes. Colored cottons wash with lukewarm soap lyes. Colored woollens the same, or ammonia. Silks, absorb with French chalk or Fuller's earth, and dissolve away with benzine or ether.

Gum, Sugar, Jelly, etc.—Simple washing with water at a hand heat.

Iron Spots and Black Ink.—White goods, hot oxalic acid, dilute muriatic acid, with little fragments of tin. On fast dyed cottons and woollens, citric acid is cautiously and repeatedly applied. Silks impossible.

Lime and Alkalies.—White goods, simple washing. Colored cottons, woollens, and silks are moistened, and very dilute citric acid is applied with the finger end.

Matter adhering Mechanically.—Beating, brushing, and currents of water either on the upper or under side.

Oil Colors, Varnish or Resins.—On white or colored linens, cottons or woollens, use rectified spirits of turpentine, alcohol, lye and their soap. On silk use ether, benzine, and mild soap very cautiously.

Scorching.—White goods, rub well with linen rags dipped in chlorine water. Colored cottons, redge, if possible, or in woollens raise a fresh surface. Silks, no remedy.

Stearine.—In all cases, strong, pure alcohol.

Tanning from Chestnuts, Green Walnuts, etc., or Leather.—White goods, hot chlorine water, and concentrated tartaric acid. Colored cottons, woollens and silks, apply dilute chlorine water cautiously to the spot, washing it away and re-applying it several times.

No. 63.—*To remove Nitrate of Silver stains from Woollen or Linen Cloths of any kind.*

Iodine 1 drachm, iodide of potassium 1 ounce, mix. Dab the stain with the above mixture, and in about half a minute wash with 1 ounce of cyanide of potassium, in 5 ounces of water.

No. 64.—*To Extract Paint and Tar.*

Benzoline is no doubt as good a solvent as can be found. If woollen goods, moisten the spot, then rub, and moisten and rub again until out. For silk, lay it on a tea tray and sponge it out, or use a hand brush. If there is much on the garment, it may first be plastered over with fresh butter or lard to soften it. Spirits of wine, or methylated spirits, is used by some in lieu of benzoline. Pure naphtha, or benzine, is the same thing as benzoline.

No. 65.—*To Extract Wax Tallow Spots.*

Dip in benzoline, and rub them, and they will quickly disappear. Aleal may be used in place of benzoline.

No. 66.—*Good Scouring Soap.*

Take 50 pounds of Greenbank pure caustic potash in an earthen or metal vessel, with 9 gallons of water (90 pounds). Stir it twice, it will then become quite hot. Let it stand till cold. Place in another vessel $22\frac{1}{2}$ gallons cotton seed oil, pour the dissolved potash very slowly upon the oil, well stirring it all the time till they are perfectly combined, and in appearance like honey. Now cover it up and put it in a warm place till next day. Then stir up again and let it stay 3 days, when it will be quite even. The result yielding about 345 pounds of very stiff potash soap, more concentrated than fig soap.

No. 67.—*To make Soft Soap.*

Take 200 pounds of the above soap, add to it 7 gallons (70 pounds) water, put it into a pan and gently heat it up, stirring it all the time. When well mixed, add 7 pounds of crystal carbonate of potash, this will remove all stringiness and produce a clear homogeneous soap.

The above cold process is both simple and effective; any one can make either small or large lots by it. It is in all respects far preferable for wool scouring than the ordinary soda soap, as the wool scoured by it will be both whiter and softer.

Linseed oil, tallow, or grease can be used in part, or entire in place of cotton seed oil, if any of the others are handier to get.

1 part of hempseed oil and 1 part of the cotton seed oil, will produce a color like olive oil soap. Potash, not soda, should be used both in making and using soaps for wool scouring.

No. 68.—*Test for Soap.*

20 parts are dissolved in water, and then mixed with 5 parts of diluted sulphuric acid. The fat will then rise to the top, and the mineral impurities fall to the bottom. In this way the most flagrant adulterations can be detected.

No. 69.—*Washing Crystals.*

Many different preparations are sold under the above name, and a great deal is claimed for them. After giving a general outline of what they are composed of, I will then let the reader judge if they are of any value to him.

Virmmelbern's wool washing composition.—35 parts of dried soda, 10 parts of soap powder, 10 parts sal ammoniac.

Ward's wool washer.—90 parts of effused soda crystals and 10 parts of soap powder.

The Universal washing powder.—A water glass containing soda, with a small percentage of tallow soap and starch.

Several, well advertised, are simply washing soda with from 1 to 5 per cent. of borax, while some even contain Glauber's salt and others common salt.

No. 70.—*Finest Elastic Starch.*

You can buy it, or make it as follows: Melt 1 pound stearine, and when cold powder it, and mix with 15 pounds of starch.

No. 71.—*Berlin Brilliant Dressing Starch.*

Mix from 2 to $2\frac{1}{2}$ pounds of borax with 100 pounds of starch made from wheat.

No. 72.—*Animalizing of Vegetable Fibre.*

(By J. M. A. Louis Bonneville.)

The nitro-saccharines and nitrous products of the different kinds of sugar are obtained, if common or any other chemical sugar is introduced into hydro-nitric acid of the specific gravity of 1.500 to 1.520. It is better, however, to mix this acid with commercial

sulphuric acid of 66 degrees. I have established by actual test the proportion of 2 parts sulphuric and 1 part nitric acid. The mixture is applied cold.

As soon as the nitro-saccharine has formed, *i. e.*, as soon as the powdered sugar has been stirred into above mixture, and become a cohesive mass, it is taken out, while permitting the acid to drip, and washed under strong kneading in repeatedly changed warm water. When all adhering acid particles have been washed away, it is indissoluble in water, and must, upon a drawing into threads show a pearly silver lustre.

One kind of application is based upon the fact that nitro-saccharine, be it applied to fibre either in form of a solution or directly, imparts to it not alone a singular lustre, but also the property to become capable of being dyed like animal fibre, silk, or wool. The fibres receive the same lustre, and the dyeing proceeds quickly and securely, with the same color shades.

Plant fibre (it is immaterial in what form it occurs, whether as fabric, felt, or paper, or any other cellular stuff), becomes wet when immersed in a warm (about 40° C., 104° F.) solution of refined sugar of 10° B. for one hour. Little by little sufficient sugar syrup is added, until the solution has attained to 25° B. During this adding, the temperature is raised to about 80° C., and in one half hour the textile stuff to be treated will be thoroughly impregnated with sugar.

The stuff is then dried in drying rooms, literally by degrees; then quickly agitated for from five to twenty seconds with the above-described acid mixture; finally, it is passed between the gutta percha cylinders, to press out any superfluous and adhering acid-particles. After removal from the cylinder presses, etc., the article is vigorously rinsed in a cold and strong stream of water, and thoroughly cleaned, drawn through a light luke-warm soap bath, and then exposed to the warm drying roller. Thus this mass, not altered in an organic but a chemical manner, may be dyed in the same manner as silk and wool, and the imbibed stuff cannot even be extracted by boiling with hot soap lye.

Aniline and picric dyes act thereupon without mordants. Turkey red and Adrianapolis red can be obtained by single drawing through. Vegetable fibres treated in this manner may be

mixed with waste, and as such mixed with animal fibres, may be worked into yarns or fabrics.

Solid nitro-saccharine, produced of powdered sugar and acid, is dissolved warm in its dissolving agents, such as acetic acid or methyl-alcohol, and the textile fibres are, in accordance with the quantity to be treated, left exposed in it for a longer or shorter period. This method of treatment of the plant fibres, be it either applied in free air or under pressure, is necessary and important for strengthening and weighting a silk hank, to give it lustre, and to increase the tinctorial properties of fancy or woollen fabrics, to ground all kinds of yarns and stuffs; as substitute of albumen, to incorporate the nitro-saccharine with the dyes to be applied upon fabrics and paper. It is necessary in cases where the application and direct formation of the nitro-saccharine upon the stuff under treatment is not possible. It may also be used as a brilliant varnish, and entirely replaces the collodion and gelatine in photography.

No. 73.—*Latest Triumph on Fixing the Azo-Colors upon Cotton.*¹

By H. Wolff.

Of the acquisitions of modern chemistry none have probably acquired a practical importance so rapidly as the discoveries in the region of the azo-colors. The splendid shades, not merely fast, but relatively cheap, which were first obtained upon wool and silk with the dyes furnished by Meister, Lucius & Bruning, went beyond the boldest expectations. During the last two or three years the number of these colors, both patented and not patented, has remarkably increased, though to the above-mentioned firm still belongs the merit of having first placed valuable products of this class in the hands of the dyer, which indeed may still claim the first rank among the azo-colors. Still their application upon vegetable fibres remained a desideratum, and as the constitution of these colors became known this failure could not be thought surprising.

The various methods proposed for applying the ponceaus,

¹ ("Leipziger Faerber und Zeugdrucker Zeitung.")

oranges, Bordeaux, tropeolines, etc., upon cotton gave brilliant shades, which would not even bear cold soaping, and consequently did not admit of a general application. If we ask for the causes of this phenomenon they appear readily from a very simple theoretical consideration, which has been hitherto disregarded by dyers. Almost all the azo-dyes hitherto introduced into commerce are sulpho-acids of the phenol, or of the diazo residues, or of both conjointly. Sulpho-acids of other coloring matters, probably on account of their ready solubility in water, have long been used. I mention merely the sulpho-acids of indigo (extract of indigo and indigo purple), and the sulpho-acid of triphenylrosaniline—soluble aniline blue. The experience of the dyer with these colors repeats itself with the azo-dyes. The sulpho-acids have a considerable affinity for animal fibres (silk and wool), but a very trifling affinity for unmordanted vegetable fibre. Upon these they would have to be fastened by insoluble, or very sparingly soluble, metallic compounds, but such do not exist. All the compounds of these dyes in the state of sulpho-acids, with the oxides of the heavy metals, are more or less readily soluble. On the other hand, these sulpho-acids unite readily with the nitrogenous animal fibre to form insoluble compounds. So long, therefore, as it is not possible to animalize the vegetable fibre, especially cotton, with solutions of wool and silk, it will be useless for the colorist to make experiments for the purpose of fixing these beautiful colors upon cotton by means of the recognized mordants.

But is the cotton dyer, therefore, compelled to renounce these colors? Certainly not; but he must take another way for their fixation. According to what has been said above, nothing remains but to produce the coloring matter upon the fibre, avoiding the sulpho-acids. The way to be entered upon for this purpose is very simple, and two patents have been latterly taken in this direction. The diazotising process of Grässler (German patent, No. 14,950) is only important for calico-printing, and will therefore not be discussed here. The second patent was taken out in England by Holiday, and is, I believe, not extended to Germany. If the dyer makes experiments according to the process specified in the patent, the unsatisfactory results will soon deter him. I will therefore point out the way to a successful issue.

The formation of the coloring matter upon the fibre can be effected by saturating it first with the solution of a salt of diazobenzol, and then with an alcoholic solution of the required naphthol (*a* and *b* naphthol, phenol, resorcine, etc.). The coloring matter is easily formed in an alkaline solution, but the process in many cases is not hindered by the presence of free acetic acid. The sulpho-acids, both of the phenols and of the diazo compounds, must never be used, otherwise we produce the above-mentioned compounds, whose solubility renders their fixation upon cotton impossible. Holiday's patent contains the application of the sulpho-acids.

The difficulties which the dyer encounters lie first in the preparation of the diazo solution. The temperature and the concentration of the solution have great influence upon the success of the process, and the object of the writer is to preserve the dyer from useless experimentation. The diazo compounds are obtained by the action of the nitrite of soda upon aromatic amido compounds, such as aniline, toluidine, naphthylamine, etc., in acid solution.

Thus there is formed, *e. g.*, muriate of diazobenzol by mixing a solution of muriate of aniline with nitrite of soda. The practical production of these and other diazo solutions will be explained below. The solution of the nitrite of soda is poured into that of the aniline, etc. In ten minutes the solution is ready for use. Quantities should only be prepared for immediate use, as decomposition sets in after twenty-four hours. If the directions given below are observed, the formation of resinous matter may be avoided for at least six hours. If it ensues afterwards, the solution must be strained through a cloth just before use.

The quantities of phenol, naphthol, etc., required, are dissolved in soda-lye and mixed with a little ammonia. The solution quickly becomes clear and keeps well. The more dilute the solutions the better the result. The cotton, perfectly clean, is first worked in the solution of phenol (naphthol, etc., as the case may be), wrung well, and entered in the diazo solution. After being again wrung, the formation of the process is completed in the first (phenol, etc.) bath.

The entire process must then be repeated according as a lighter or heavier shade is intended. The phenol bath is always used last,

and is followed by a good rinsing. A hot soaping raises the colors and hinders them from rubbing off. Very fiery shades are obtained if the yarns are previously steeped for some hours in muriate of tin at $2\frac{1}{2}^{\circ}$ to 4° Tw.

It can scarcely be avoided that some superfluous color will be precipitated upon the fibre, but this is removed by the hot soaping and rinsing. The color produced upon the fibre is absolutely insoluble, very slightly sensitive to air and light, and leaves little to be desired on the score of fastness. As the patent of Messrs. Holiday claims only the production of the sulpho-acids in the form of a powder, and the Grässler process is here not touched at all, the dyer need fear no unpleasantness in the use of the following methods:—

Considerable as are the numbers of the possible compounds which may be produced upon cotton fibre, there are but few of any practical importance. The fiery scarlet, which can be fixed upon wool with "Ponceau 2 R," cannot be obtained in this manner. Repeated experiments, extended to all hitherto known diazo-colors, gave me proof that the possible colors are confined to orange, red orange, yellowish red, and Bordeaux. It does not follow that these will always remain the only possible shades. New compounds will doubtless be found applicable for the formation of azo-dyes, and may extend the above-mentioned list.

Orange. 1. Naphthol bath:—B-naphthol, 2 pounds 10 ounces soda lye, at 76° Tw. (diluted with water), 2 pounds 10 ounces, ammonia (sp. gr. 0.949) $1\frac{3}{4}$ pints.

2 Diazo-benzol bath:—Aniline, pure, $27\frac{5}{8}$ ounces. Dissolved in muriatic acid, 32° Tw., 7 pounds 9 ounces, and diluted to 525 pints. Then add nitrite of soda 20 ounces, dissolved in water 175 pints.

Red Orange. 1. Naphthol bath as above.

2. Diazo-toluol bath:—Pseudotoluidine, liquid, 31 ounces, are dissolved in muriatic acid, 32° Tw., 7 pounds 9 ounces, and diluted to 525 pints. Then add nitrite of soda 20 ounces, dissolved in water 175 pints.

Yellowish Red. 1. Naphthol bath as above.

2. Diazoxlyol bath:—Xylidine 2 pounds 3 ounces, dissolved

in muriatic acid, 32° Tw., 7 pounds 9 ounces, dilute to 525 pints, and add nitrite of soda 20 ounces, dissolved in water 175 pints.

Bordeaux. 1. Naphthol bath as above.

2. Diazonaphthaline bath:—Naphthylamine 2 pounds 10 ounces, alcohol 3½ pints, muriatic acid, 32° Tw., 7 pounds 9 ounces; stir up, let stand some hours, and dilute with water 525 pints. Add nitrite of soda 20 ounces, dissolved in water 175 pints.

This diazo solution is not fit for use till it has stood for two or three hours, and must be strained through a cloth.

The use of certain other bodies, such as anisidine, amidobenzoic acid, etc., can scarcely be entered upon at present, as they are not readily procurable. Still they should not be forgotten, as some improvement in their manufacture may reduce their prices.

With the quantities given above, lots of 6 to 9 pounds can easily be dyed. Purity of the substances used is here essential under penalty of obtaining disagreeable, brownish-red shades. The same establishments which furnish the soluble naphthol colors will probably be the best sources for b-naphthol, xyloidine, etc. The expenditure for material will be about 5 cents per pound of cotton.

The fundamental notion of the above memoir is to draw the attention of the dyer to the circumstance that the production of colors upon the fibre must in course of time play an important part in dyeing. The azo-colors, of which I have been treating, do not stand alone. Artificial indigo (the preparation of which is certainly suspended for some time) will not be offered us as such, but as orthonitrophenylpropionic acid, from which the color will be produced upon the fibre.

We also produce aniline black upon the fibre. As probably the discoveries of synthetical chemistry will shortly make us acquainted with a great number of leuco-bases derived from substituted methan, leuco-bases which may possibly be fixed upon the fibre and converted into their respective colors by appropriate oxidizing agents, a second and remunerative field of labor is here laid open for the thoughtful colorist. This remark must not be taken as vague hypothesis. It is supported by experimental observations which I have made with the leuco-base of malachite green, and the product of the action of chloral upon dimethylaniline cot-

ton, mordanted with bichromate, yielded in the first case a bright green, and in the second a very fine violet.

At present, indeed, we can produce these two colors more conveniently and faster with the dyes themselves, but tinctorial chemistry will furnish us with many other products of the same series, the application of which may prove important and remunerative.

No. 74.—*Wonders of Aniline Chemistry.*

Aniline colors are manufactured by treating one or more of three substances—viz., benzole, anthracine, and naphthaline—with salts of copper, salt, and other chemicals and acids, under various conditions of pressure and temperature. The benzole, anthracine, and naphthaline are obtained from the decomposition of coal-tar in the following proportions:—From 100 pounds of coal-tar there are derived, benzole $2\frac{1}{2}$ to 3 pounds, anthracine $\frac{1}{4}$ to $\frac{1}{2}$ pound, naphthaline 6 to 8 pounds.

There are thus derived from each 100 pounds of tar from 9 to 12 pounds of products available for the purposes of aniline manufacture. Of these the most important is benzole, which is composed of twelve parts of carbon and six of hydrogen. It, therefore, offers the two fundamentelelements in proportions which, when combined with other elements by chemical processes, produce a great variety of brilliant coloring matters and practically perfect substitutes for numerous organic materials of large commercial value.

Thus far in Europe the distillation of coal-tar and the manufacture of aniline colors have not been combined by any one establishment. The manufacture of aniline materials from the tar is one branch of business; the production of colors from these materials is quite another. Aniline color-makers prefer the English benzole as being more rich and productive, although benzole is largely manufactured in France and Germany. The English product costs in London from \$1 to \$1.10 per gallon; that made on the Continent is somewhat cheaper.

From anthracine, the second product of coal-tar, is manufactured alizarine, the substance which has almost entirely superseded madder and destroyed the profitable culture and sale of that comparatively expensive vegetable dye-stuff throughout the world.

From naphthaline is made the beautiful variety of light albo-carbon colors, so important in the repertory of modern dye-stuffs.

There are now manufactured in the four large aniline color laboratories within the district of Basle, Switzerland, between forty and fifty different dyeing materials, which are variously used for coloring silks, cotton, leather and other substances, as well as for the manufacture of colored writing and printing inks. Many of these colors are readily soluble in water, and unite perfectly with the goods without the use of a mordant; others are soluble in alcohol or water impregnated with acids, and still others require the use of mordants to render the color clear and permanent. The strength of coloring capacity of some of these dyes is wonderful, a single grain or crystal of the solid pigment being enough to make a dye sufficient to color a large quantity of textile material. Another noticeable quality is the superior affinity of the aniline color for the fabric to be dyed. This is so positive that in many aniline dyes repeated immersions of silk, cotton, or wool take up the whole amount of color, leaving the water or spirit in which it was dissolved almost transparent and pure.

The value of the recently discovered indigo substitute will be apparent when it is remembered that while vegetable indigo costs at wholesale in Europe \$3.20 per pound, this aniline substitute for it, which produces a scale of perfectly solid, permanent colors, can be created in exhaustless quantities and sold at a profit for fourteen cents per pound. Even in India, where the culture of vegetable indigo has long been an important branch of agriculture, and in China and Japan, where the popular taste for color amounts to a passion, these aniline dyes are rapidly superseding all others, and a large proportion of the colors manufactured in the district of Basle are sent directly to the remote East.

From the American standpoint the whole subject of aniline chemistry is undoubtedly of the highest interest and importance. Coal-tar, as well as the fuel and other materials used in the distillation of benzole, anthracine and naphthaline from that substance, are all more cheap and abundant in the United States than in any part of Europe. The acids and chemicals required in producing aniline colors from the three products named may be somewhat more costly at home than abroad, but the high duties which are at pres-

ent levied on imported aniline colors will far more than compensate for this slight disadvantage. It is simply a question of how soon American capitalists will see their opportunity, and by engaging practical and competent European chemists, establish this wonderful branch of manufacture on a large and profitable scale in our own country. In order to attain the best results the scope of a single firm should include the production of aniline materials from the tar, as well as the manufacture of colors from these materials by the methods already in use.

The production of benzole from the refuse of petroleum was discovered about three years ago by a professor of chemistry in the Polytechnic School at Zurich. His process consisted in passing the petroleum vapor over a surface of heated bricks or tiles; but just at the moment of success the overworked brain of the chemist became deranged, and in a fit of temporary madness he committed suicide, leaving the only knowledge of his discovery with a clever young student who had served as his assistant in the laboratory. The student resumed the experiments, attained what was regarded a practically successful result, patented the discovery in the United States, and has recently established a laboratory there with capital furnished from Basle, to develop his process on a commercial scale. It is believed by those in the best position to know all the facts that the success of this enterprise is already demonstrated.

Within the past few months some notable discoveries have greatly enlarged the scope of aniline production. From benzole, as derived from petroleum, there are now produced, in experimental quantities, extracts of vanilla and cinnamon, which are chemically identical with the same extracts produced from natural vegetable materials. Not only this, but the German chemists have essayed to produce quinine by similar methods, and have already attained results that warrant their confident expectation of early and complete success.

There is now in process of organization in Central Europe a company with large capital to establish in the United States a manufactory of flavoring extracts and substitutes for various vegetable drugs from aniline materials.

The circumstances under which this information has been obtained preclude a more detailed allusion to the subject in this con-

nection, but the mere statement of the fact should be sufficient to show the rapidly broadening field of aniline chemistry and indicate its future possible importance as a source of wealth in the United States. All these discoveries are of vast commercial value, and are, as a matter of course, carefully guarded.

The earliest fruits of such inventions will be inevitably harvested, even in the United States, by European capitalists and their chemists, who are so far in advance of their American competitors in this whole field of research; but it is contrary to the traditions of American enterprise that our country should remain permanently dependent upon foreigners for what can be readily manufactured at home. It is asserted, with what truth I am unable to judge, that in so far as the manufacture of aniline colors has been attempted in the United States the result has been more or less unsatisfactory, the home-made dyes being inferior in quality to those imported from Europe. If this is true, the only cause for it must be want of experience and skill in the process of manufacture.—*Report of Consul Mason.*

It is a pleasing fact that, after several defeats, some anilines are now made in this country equal to any imported article.

F. J. B.

No. 75.—*The So-called Dry Dyeing with Benzine.*

[Patented by Messrs. Armand & Berton].

Take oleic acid, stearic acid, margaric acid, or the acid used by the inventors, add the desired aniline dye, and shake the mixture until the aniline dye dissolves. According to the nature of the dissolved stuff, next add a certain quantity of volatile alkali, or a concentrated solution of soda or potash, or sulphuric ether, and pour the mixture into benzine, whereby most admirable colors are obtained. The same purpose may also be obtained in the following manner:—

The oleic acid and the dissolved color are poured into benzine, which has previously been saturated with volatile alkali, a solution of potash or soda, or sulphuric ether.

[The aniline factory of Berlin prepares aniline dyes only soluble in fats or oils, benzine, etc.]. See, also, page 249.

No. 76.—*Indophenol*.

Koechlin and Witt reduce nitrosodimethylaniline in an acid solution with zinc dust, and add an alkaline solution of Greek alpha and naphthilic acid and chromate of potash. A blue dyestuff arises thereby, the indophenol. When dried, it completely resembles Guatemala indigo, dissolves in concentrated sulphuric acid with a blue color, turning into a dirty red upon dilution. For dyeing wool, the color paste is reduced in an alkaline grape sugar solution at 80° C. to a real vat. Thereupon dilute and dye, as with a vat. The wool, upon issuing from the vat, is of a dirty green color, and becomes converted into indigo blue by oxidation. The chromates are used as oxidizing agents. The leukindophenol is closer related to the animal fibres than the indigo white, and it adheres therefore upon the fibre by washing; it must, however, be oxidized by oxidizing agents. The dyed wool is fast against fulling, but less resistable against the mineral acids. Concentrated baths must be used for dyeing the plant fibres, the indophenol having but little affinity for them. The blue dyestuff may also be produced directly upon the fibre, as follows: 1. The fabric is blocked with a solution of naphthyllic acid in soda lye, with a thickened mixture of chlorate of nitrosodimethylaniline printed with a reducing body only in presence of alkali, grape sugar, peroxide of tin, or milk sugar. The color develops upon steaming. 2. The fabric is printed with the grape sugar solution, and a thickened mixture of nitrosodimethylaniline and naphthylate of soda printed over. Steam, 3. The chemicals are printed first, steamed, and finally passed through chromate of soda. The colors obtained cannot be distinguished from those of indigo blue. They resist both soap and chlorine better, and are cheaper. The nitric acid test gives the indophenol exactly like indigo. It is more fast to light than indigo.

SECTION XIV.

MORDANTS AND DYE WARES.

THE NAMES OF COLORS.

PRY it is that so much confusion arises from the numerous names given to the same dye wares, and to the same shades of colors. Surely it is high time that some joint action was taken by the leading technical schools to correct the mistake of having so many names to one thing, or one shade, or if there must be a plurality of names at least let them refer to the one thing or one shade. As it is, one may read a formula for cardinal, and unless it is accompanied with the shade it produces, it may mean anything from a ponceau to a claret. So much divergency of opinion exists even in the United States that I often have to send and ask what shade is meant by the name employed. That some difficulty would be met in the task I am willing to grant, more especially in reference to the shades, yet that it is insurmountable I cannot accede to, as take blue for instance, which I here select because of its more numerous shades than perhaps any other color. Yet the difficulty could be gotten over by numbering the shades, so as to make a standard of reference, it may be from 1 to 100, or even to 1000 if the case required it, the same to be recognized at least in the same country, if impracticable for every country. It would then be easy to say No. — in blue can be dyed by such and such means. Every one could then look and see if that was the shade he required. I believe the paint trade has a standard of colors.

Every one has not had the advantage of a chemical education who even against this disadvantage have by dint of perseverance made their mark; the fact being that a chemical knowledge was not considered essential to a dyer by the majority of the trade thirty years ago. It is quite true a man may make a good dyer without it, but the same man would have made a better one with

it, and he saved many annoyances of trying this and that formula which, containing no true assimilation or agreement, therefore proved abortive. As it would also often save one the bother of finding out what a certain chemical means, as an example I will mention two cases. A formula called for $\frac{1}{2}$ ounce of hydrochloric acid (the term often used in bleaching), the man went to his druggist and paid twenty cents for it, afterwards finding that he had plenty of it in his store, only called by the less pretentious names of muriatic acid or spirits of salts. The other called for a few drachms of muriate of soda. For this he had to pay fifteen cents, and afterwards was mortified to find it was only common salt. Thanks for the fact, chemistry is now appreciated as a help to dyeing, and those who avail themselves of it will be employed for their brain power, while those who do not, will be employed for their machine power. Let any young man who may read my book remember that when house is gone and money spent then learning is most excellent. American young men would make good chemists if only they liked application better. Why is it that nearly all the chemists here are Germans? For the reason that the American boy loves play and going around, better than reputation for practical study. If this state of things continues it will be very mortifying to find in a few years that the born American has allowed strangers to fill all the best positions in the technical arts and sciences of his own native land. To be well warned should be to be well armed.

"Scarcely a European exchange comes to us," says an American textile journal, "in which we do not read of the wonderful results attained year after year, generation after generation, from the excellent technical schools, which are patronized by so many thousands of intelligent young men. Germany, particularly, seems destined to be Europe's industrial teacher. More than ever, a larger number of foreigners participate in the practical studies. Belgium comes next; recent statistics show that she has rapidly developed her industrial schools and counts now 59 technical and 32 industrial, not mentioning her commercial high schools. Surely some one of our philanthropists and wealthy textile manufacturers could immortalize his name, by giving a foundation to such an institute. *When are we going to learn?*"

MORDANTS, THEIR NATURE AND USE, AND HOW TO
MAKE THEM.No. 1.—*Oil Mordants for Aniline Colors.*

Say 2 pounds of oil are agitated with $7\frac{1}{2}$ of alcohol, $7\frac{1}{2}$ water are added and $\frac{1}{2}$ sulphuric acid. The whole must be thoroughly mixed to an emulsion before use. In France, where alcohol is dear, the acid is added directly to the oil, then the water poured in, and the whole agitated.

No. 2.—*Tannin as a Mordant and how to make.*

Tannin, as Dr. K. M. Kurtz observes in the Wurt Groltt, came largely into the dyeing trade as a mordant for cotton, union cloth, silk, mixed silk, artificial wool, etc., and justly so, for while the dyer, by using other tannin materials as sumac, galls, myrobalans, divi divi (articles of which the value varies according to the degree of maturity, the time of plucking, the method of drying, etc.), is compelled to crush, grind, powder, sift, boil, and filter them. Tannin, which is a constant product of uniform composition, can be dissolved in water without further preparation. Tannin is certainly not cheaper, but much time, labor, and other incidental expenses are saved by its use, and it works cleaner. One pound of tannin represents the effect of about 40 pounds of sumac, 18 pounds of myrobalans, 14 pounds of divi divi, and 11 pounds of galls, besides which from 5 to 7 per cent. of dye stuff is economized; hence, it arises that upon tanned goods the color comes out purer and brighter in an unequalled degree. Commercial tannin is now prepared chiefly from so-called Chinese and Japanese galls (from sumac). These are well dried, converted in a stamping mill to the finest powder, which is extracted four times systematically with a mixture of three or four times its weight of the best rectified alcohol and ether, in small or large cylindrical vessels of tin plate, kept in agitation by hand or mechanical means. The alcoholic solution is then distilled off by steam in a copper retort, and the remaining tannin taken up in about double or three times the quantity of hot condensation water, and set aside for a day. There now separates a rather considerable quantity of a green, resinous body insoluble in water, on the surface of the tannin so-

lution, from which it is drawn off. If the solution is not clear, it may be passed through a charcoal filter. It is now evaporated in a double cased boiler in the steam bath till the water is driven off. As a tannin solution in the air, particularly if hot, darkens strongly, the access of the air is to be restricted as much as possible, and for this a copper vacuum apparatus is recommended. When the water is driven off the thick fluid, tannin is poured into moulds of tin plate, where it is left to stiffen, after which it is powdered in the so-called indigo mills with cannon balls and sifted, as it is usually required in commerce, as a fine powder, which quickly dissolves. The more ether is employed in the extraction of the galls in proportion to the alcohol, the whiter is the tannin. Alcohol alone dissolves a considerable amount of dyestuff. Water cannot be used for a first extract, as it dissolves too much dye and other foreign substance, which cannot then be separated from the solution. For many technical purposes a tannin prepared alone with a spirit of high degree is as valuable as that prepared with alcoholic ether, to which a smell of ether obstinately adheres. The consumption of tannin besides being largely used in pharmacy, in the wine and beer pathology, is at present very much on the increase, and its production is a very profitable branch of many chemical manufactories. Many dyers combine with the employment of tannin that of so-called oil or animal mordants (olein sulphate of ammonia) which gives more fire to the color, especially carmine, and thus leads to an economy of dyeing material. The preparation is simple: In a large dish, to about 60 pounds of best cotton-seed oil are added 30 pounds of sulphuric acid, at 66° B. with gradual stirring. The mass becomes heated, evolves much sulphurous acid, and is stirred till it becomes quite homogeneous, when the mixture (the olein sulphuric acid) has cooled again, so much dilute spirit of ammonia is added with continued stirring, that the remaining liquid smells of it, weighs about 5 cwt., and presents a homogeneous bright, yellow, soapy paste, but whether the above preparation, in proportion to its effect, will not become too dear, Dr. Kurtz cannot decide.

No. 3.—*The Application of Tannic Acid and Glue for Fixing Aniline Colors.*

The fixing of aniline colors on vegetable fibres, is far more difficult than on animal fibres, as in the former case mordants are always requisite, but in the latter they are mostly unnecessary, or of secondary importance. Wool is often more beautifully and vividly dyed with aniline colors, without mordanting, and the mordants are used chiefly either for the purpose of attaining a higher temperature in the dye bath, or to give the dye stuff greater permanency, but especially also to avoid the unevenness which so easily occurs with aniline dyes upon wool.

Cotton and linen fibres will not combine with tar colors without a mordanting medium, and it is necessary in all cases to look out for materials which are capable of rendering the soluble aniline dyes insoluble on the fibres. The series is by no means small, and it is only a question to decide which of the mordants used in practice is the most advantageous, and will yield at the same time the finest and cheapest colors. This question cannot well be decided by experiments on a small scale. It is only by operating with large quantities, and by manufacturing processes, that results are obtained which lead to a correct decision. The dyer in fine colors will for the most part have no opportunity to decide which is the most suitable method for fixing aniline colors upon cotton. In this question the productiveness of the bath employed must be well considered, and their value be deducted from the total cost in the calculation of the materials used.

It would lead too far to discuss here the various methods of fixing aniline colors. They have nearly all been displaced by the method of mordanting with tannic acid, and many expert practical men have by this time decided that tannic acid is the medium to be preferred to all other mordants for dyeing with aniline colors on cotton. This is specially the case with magenta and aniline green (iodine green). These two dye-stuffs yield, with tannic acid, beautifully colored and completely insoluble combinations, and thus tannin answers most fully the purpose of a genuine mordant. Tannin is nevertheless a tolerably expensive preparation, and consequently an effort should be made to find a

substitute for it, a mordant which either renders it quite superfluous or admits of some economy in its use. The materials hitherto proposed, oleic and stearic acids in soaps, etc., do not satisfy the requirements, and it is not likely that a substitute will easily be found to displace tannin entirely; a long series of experiments on a large scale has led to the conviction that tannin (either pure or in sumac) is temporarily at least indispensable. On the other hand, tannic acid may be considerably economized by combining it with size before dyeing, and thus using tannin and size at the same time as mordant; in order then to produce a certain tint with magenta or iodine green, or any other aniline color, far less tannin is required. In fact the same result may be obtained with half the tannin, which is obtained with double the quantity, without the use of size, as the following experiment will illustrate. In the first place the cotton was dipped in a tannic acid bath, then divided into two parts, the one drawn through a weak solution of size or gelatine, and the other dyed directly in a bath of known concentration at a certain temperature. The portion drawn through the solution of size was then dyed in a bath exactly similar, and the two samples were then compared.

The cotton mordanted with tannin and size was by far more fully and deeply dyed, and it may be affirmed that by using a size bath after the tannin bath, the latter may be used much weaker than when tannin alone is used for fixing the dye-stuff. In this way tannic acid may be economized to a considerable extent. By diluting the tannic solution more and more, and comparing the results with tannin and size, and with tannin alone, a point is reached in which both operations yield exactly the same shades. When this point is reached, by comparing the degree of concentration of both tannin baths, it may be determined what the saving of tannin has been; this depends much upon the quality of the tannin, so that the experiments have not yielded a result which could be reduced to figures. The samples of tannin obtained from different sources gave different results, and in one case, a greater saving could be effected with the use of the size bath, and in another comparatively less. Evidently a combination takes place between the size and the tannic acid, which then acts on the dye-stuff of the aniline differently from the tannin alone.

The following extract from the Chemical Review shows that a much cheaper mordant than tannin has been found, as follows:—

No. 4.—*Mordant for Aniline Colors on Cotton.*

Until recently, aniline colors have been fixed on cotton by treatment with animal matter as albumen, gelatine, or with galls, sumac, tannin, as well as by the use of mordants of acetate of alumina, soap, and oil. Dr. Reiman, however, directs attention to the peculiar power possessed by starch of abstracting aniline colors from solutions. This is not due to the gluten it contains, since this property is shared equally by wheat and potato starch; and he founded upon this a beautiful method for fixing aniline colors on cotton. It is immaterial whether the color is attracted by the starch suspended in the liquid or attached to the fibre. If the cotton is saturated with a thin paste of potato or wheat starch and steeped in a dye bath of aniline color, it will receive the corresponding shade.

No. 5.—*Mordants for Aniline Colors.*

Many things have been introduced from time to time, with more or less success, to enable cotton goods to take up the colors quickly and brightly.

The following are the various mordants and their results. Sumac has always found more or less favor, and unquestionably it has its advantages. It is cheap, the liquor can be used for other purposes; and most dyers know how to use it, but are afraid to discontinue its use in favor of a new thing of which they know but little.

Stannate of soda, the principal advantage claimed for this is that it leaves the goods whiter than sumac, it does not require much, or indeed any rinsing. On the other hand, it is considered dearer than the former, and it does not stand exposure well. In articles of dress, garment dyers are often requested to retain black stripes and spots that may be in the goods, which stannate in a great measure discharges. It certainly rots the work to some extent, and I have found in its use black spots formed upon the work, similar to those found occasionally by the tin process in cochineal scarlet dyeing.

No. 6.—*Methylated Spirit as a Mordant.*

As this takes about eight cents worth to about twelve yards of dress material, it is generally considered too dear. But it is clean, works tolerably even, and it retains stripes, spots, etc.

N. B. Methylated spirit is much cheaper in England than alcohol, from which it is made by adding a portion of shellac to prevent its being used for anything other than manufacturing purposes.

No. 7.—*Tannic Acid and its advantages.*

This unquestionably is superior to all the foregoing, and is applicable to all purposes where any of the former can be used, and in many instances where they would not avail. The chief argument against it is its price, although it is affirmed by some practical men, considering all things, to be as economical as either of the foregoing, as it is quite soluble, easily fixes itself, and 1 pound will mordant 100 pounds of goods in half an hour.

No. 8.—*Improved Aniline Mordant.*

This differs from all the foregoing in several important respects, it is about one-quarter the price of tannic acid, while its results are similar in every respect, it is a much brighter and cleaner mordant than sumac, and has none of the disadvantages of stannate of soda. Indeed, it strengthens the work rather than otherwise, it is half the price of methylated spirits, it works evenly, and requires no rinsing. Goods can be mordanted with it in from five to fifteen minutes; it is chiefly recommended for red, violet, brown, green, slate, grays, etc., on cotton or mixed goods.

The inventor is a practical dyer, supplies printed instructions, and may be communicated with on any points relative to his invention. Some think it a saving to use half the quantity of tannic or aniline mordant, and about three times its weight of glycerine; others use about two parts of mordant and two parts of best starch; whilst others still recommend to mordant in a prepared oil bath; and others consider oil and glycerine combined to be an improvement.

No. 9.—*Starch Valuable to fix Colors.*

All loose colors, especially anilines on mixed goods, should be passed hot in a clear, well strained starch liquor. It fixes the color and gives substance to the goods, it should of course be boiled and then used thin, it hurts no color.

No. 10.—*Aleppo Galls as an Aniline Mordant.*

There are many kinds of nut galls, but the above are the best. As they are so well known it is only requisite to say that they are of a greenish blue tint and should be free from worm holes. As a mordant, they are quite valuable and only require bruising or grinding, and boiling. Decant the clear liquor and steep the goods in them. From 1 to 8 pounds are required for 100 pounds of goods according to shade.

No. 11.—*China Galls as an Aniline Mordant.*

They are of a much later introduction in the dyeing trade. Instead of being a nut in the proper sense of the term, they are not, as they much more resemble a bony looking hollow shell, of all conceivable shapes, no two excrescences form alike as they ooze from the tree in the form of gum. They are much the color of dry bones. They are reduced to a fine powder, and used in the same way as nut galls.

No. 12.—*Myrobalans*

are also of recent introduction into the dyeing trade. They are more of the egg shape than otherwise, and are much the same color as low quality nut galls, a yellow drab. No doubt they had been used some time for tannin purposes before they were much thought of for dyeing purposes. For both they are very useful. Like galls the quality varies very much, and it requires much judgment in their selection, as some are very valuable, while others are not much stronger than sumac. They are used in the same way as sumac, and should at least be double its strength.

No. 13.—*Sumac.*

An article so well known and so easily obtained only requires a passing word for the sake of the uninitiated.

The best kind has always been claimed as the Sicily, but at the present time a counter claim is put in for that of South American growth as being often as good as the Sicily. It is sold invariably in a ground state as a greenish drab powder, and if good, as soon as a barrel is opened it emits a scent quite strongly resembling whiskey. 8 to 100 pounds suffices for some colors, while scarlets and other spirit colors require even 40 to 100 pounds. I have seen as much as 60 pounds recommended, as the passage through the tin liquors cuts it considerable.

No. 14.—*Cutch*

is the name used for catechu, and is well known as a drug for fast brown. It has likewise been used as a mordant for aniline colors. That it does contain a large amount of tannin is quite true, but as it gives a deep body or color to the goods, it can only be used to advantage as a mordant for dark colors. But as other mordants can be used for light or dark colors, this finds but little favor as an aniline mordant.

No. 15.—*Valonia*.

This is a nut containing a considerable amount of tannin, and for that reason has been used to some extent for leather, and to a less extent for mordanting purposes. I, however, find nothing in it to give it a preference over some of the other drugs as an aniline mordant.

There are many other things that have been used, and which might have been described did I attach sufficient importance to them, but as I have given the best let that be a sufficient reason for omitting them.

As other mordants with their auxiliaries are treated upon in the article on dye-stuffs and chemicals, I shall now leave this special branch, which may be called the dry mordants, for the other branch, which may be called the wet mordants.

No. 16.—*Scarlet Spirits*.

3 pounds muriatic acid, 3 pounds pure double nitric acid. Add 2 ounces salammoniac, and feed with $1\frac{1}{2}$ pounds granulated tin.

No. 17.—*Lac Scarlet Spirits.*

3 gallons muriatic acid, 1 gallon nitric, 2 gallons water, kill with 6 pounds of tin.

No. 18.—*Scarlet Spirits, Another Way.*

Put any quantity of nitric acid and the same of clear water into a stoneware pot, the water first, then 1 pound of muriatic acid to every 5 pounds of the above, and give two ounces of tin to the pound of spirits. Add it very slowly for two or three days, otherwise it may fire, which would precipitate the nitric acid, when you would lose the spirit.

No. 19.—*Solution of Tin for General Purposes.*

9 quarts muriatic acid, 1 quart nitric, give as much feathered tin as it will take, the tin to be added at several times.

No. 20.—*Muriate of Tin.*

Same as (No. 17) without the nitric acid.

No. 21.—*Double Muriate of Tin.*

Take muriatic acid in a strong stone pot, and in a warm place, gradually feed it with as much tin as it will take, which should be at least 3 ounces to the pound suitable for cotton.

No. 22.—*Crimson Spirit (for Cardinal Shade).*

3 quarts nitric acid, 5 quarts muriatic acid, 1 pound saltpetre, give as much tin as it will take.

No. 23.—*Nitrate of Tin*

is aqua fortis killed with tin, which is used in dyeing yellows, buffs, scarlets, and crimsons.

No. 24.—*Nitric Acid or Aqua-fortis.*

This spirit is much used in dyeing. It is made from nitrate of potassa, or nitrate of soda and sulphuric acid. It will dye silk yellow of itself, but is generally killed with tin for worsteds and woollens.

No. 25.—*Nitrate of Iron*

is aqua fortis killed with iron or copperas. It is used for dyeing buffs upon cotton, and as a mordant or preparation for other colors.

No. 26.—*Nitrate of Copper*

is aqua fortis killed with copper (sulphate of copper).

No. 27.—*Oxalic Tin.*

This is a most valuable spirit for dyeing all grain colors, brighter colors being obtained by it than by either nitrate of tin or muriate of tin. It is the best destroyer of gum sometimes found in lac, and which is very injurious in dyeing. In woollens it is very penetrating, dyeing the piece through, however strong, without leaving any white appearance. As yet it is only partially known by the dyers, but much approved by those who have tested its excellency.

Note.—If not convenient to make your own spirits they can be bought ready prepared in most large cities.

No. 28.—*Substitute for Cream of Tartar.*

A mixture of 30 parts Glauber's salt with 20 parts sulphate of zinc will be in many cases an excellent substitute for cream of tartar.

No. 29.—*Mordant in lieu of Tartar in Wool Dyeing.*

The following mixtures are employed:—

No. 1. Alum, 10 kilogs. (22 lbs.).

Water, 10 litres (2.64 gals.).

No. 2. Oxalic acid, 3.5 kilogs. (7.7 lbs.).

Water, 20 litres (5.28 gals.).

No. 3. Acetic acid, 2 kilogs. (4.4 lbs.).

These three liquors are then mixed together producing a mixture which only costs 0.16 franc (3.2 cent.) the litre, (2.1 pints), or about half the price of the ordinary tartar bath.

No. 30.—*Chrome, or Bichromate of Potash.*

This is a red orange crystal, and is of very great use as a mordant in dyeing blacks and other dark colors upon worsted and woollen goods, giving greater permanency than any other mordant previously employed. Its excellent properties, in this respect, have only of late been appreciated, and it is now becoming generally used. It effects a great saving of time and expense, etc. (See article upon its proper use.)

No. 31.—*Black Mordant.*

Sometimes called black iron liquor, is made thus: 40 gallons of water, 2 pounds copperas, $\frac{1}{2}$ pound argol, 2 ounces bluestone, dissolve each separately, then add them together, and when settled pour off the clear liquor for use.

No. 32.—*Pyrolignite of Iron.*

Dissolve 10 pounds of pyrolignite of lime in 15 gallons of water, and proceed in the same way as with the acetate of iron. This method is intended for consumers.

No. 33.—*Acetate of Iron.*

Dissolve 10 pounds of lime in 15 gallons of water, then add to it gradually a solution of copperas (sulphate of iron) as long as any precipitate is perceivable. The clear liquor is the acetate of iron.

No. 34.—*Sulphate of Iron.*

Gradually dissolve 4 pounds of copperas in 5 pounds of nitric acid, then add 2 gallons of water; 1 quart of this solution to 30 gallons of water (as a stock tub) will produce good results. The solution should be added as the tub weakens, next to no inconvenience is occasioned in the making of this as it does not fume like nitrate of iron.

No. 35.—*Nitrate of Iron.*

2 gallons aqua fortis, $5\frac{1}{2}$ pounds old iron hoop with the rust beaten off; add the iron by degrees, after putting the above into

a 6 gallon pot (stoneware). In cold weather it will be required to be kept warm until dissolved.

No. 36.—*Red Liquor.*

Mix sulphate of potassa or ammonia with a solution of tersulphate of peroxide of iron. See also 40 and 41.

No. 37.—*A New Mordant for Dyeing Aniline Blue on Cotton.*

Prepare the cotton with double muriate of zinc and without washing, take it to the dye bath, which also contains a small quantity of muriate of zinc, then add to the bath gradually the aniline blue dissolved, and heat the bath gradually up to boiling point.

No. 38.—*Liquid Tartar.*

Dissolve 22 pounds of alum in 35 quarts of water, and $7\frac{1}{2}$ pounds of oxalic acid in $17\frac{1}{2}$ quarts of water, mix the two, and add 4 pounds 6 ounces of acetic acid, stirring carefully. One pound of this is equal to two pounds of tartar.

No. 39.—*Liquid Tartar.*

White argol 10 pounds, sulphate of soda 10 pounds, single sulphuric acid at 90° F. 6 quarts. Set it at 17° F.

No. 40.—*Preparation of the Acetate of Alumina or Red Liquor.*

Dissolve 120 parts of alum in 500 parts boiling water. When dissolved add a solution of 105 parts acetate of lead (sugar of lead) with 500 parts of water. Filter, and add water to the clear liquor until it marks 5° B. This clear liquor is the pure solution of acetate of alumina.

No. 41.—*Acetate of Alumina or Red Liquor.*

Dissolve 4 parts of pure alum, and in a separate vessel 3 parts of sugar of lead, then add together and when settled pour off the clear liquor.

No. 42.—*Acetate of Alumina.*

Dissolve separately 40 parts sulphate of alum, 50 parts sugar of lead, $3\frac{1}{2}$ parts of sal soda (washing soda), then add together and either filter or pour off the clear liquor.

No. 43.—*Sulphate of Alum.*

Alum prepared with sulphuric acid in its manufacture.

No. 44.—*Stannate of Soda.*

A preparation of tin and alkali, used as a cotton mordant. After which a run through a sulphuric acid bath standing at 2° B. is good for it.

No. 45.—*Red Liquor,*

otherwise called acetate of alumina (see former description).

No. 46.—*Tartar Emetic.*

A preparation of antimony and sulphuric acid, which is better bought than made.

Methyline blue and marine blue on cotton, mordant with tannin and tartar emetic.

THE DYE WARES.

Alum.—This salt is prepared from certain clays containing pyrites. It is used very extensively in dyeing, in consequence of the attraction which alumina has for coloring matter. It is used as a mordant or base for mock crimson, maroon, claret, purple, etc. Alum is sometimes used after chromings, when the color is too full, being made lighter by adding a little. When the shade is too blue, a little alum will redden it.

ANNOTTA.—This is obtained from an American tree, called *Bixa orellana*, and is imported in the form of a paste, of a brick-red color. It is soluble, or spent by pearlash at boiling heat. It is used in dyeing various colors upon cotton and silks, viz: buff, salmon, flat yellow, orange, and some fawn shades of drab. The colors may be raised by running in weak acid.

ARCHIL.¹—This is a blue-red or violet paste, obtained from the *Lichen orchella* grown in the south of France, and in the Canary Islands, where the best is produced. Alone it produces a ruby color, and a very light violet by adding a little ammonia, or other alkalies. It reddens indigo blues, and combined with logwood produces purple.

AMMONIA.—Liquid ammonia is generally distilled from gas liquor. It is sometimes made from ammoniacal salts and lime, but the best for dyeing purposes is made from urine. It is very much used by dyers for the purpose of blueing crimsons, clarets, purples, etc. It is also used in making paste cochineal.

ARGOL.—It is obtained from the juice of the grape, and is a crystallized incrustation generally found in wine casks. It becomes white when purified by solution and crystallization, and is then called cream of tartar. In dyeing, argol combined with alum is generally used in the preparation or boiling of mock crimson, maroons, clarets, and purples. It is excellent in giving solidity to these and other colors. Being a weak acid, it is the best for dyeing bright greens, working well with extract, sulphate of indigo, and is not destructive to fustic. It is frequently used in dyeing the spirit colors, as scarlet, orange, and grain crimson, but cream of tartar is preferable for yellows, pinks, salmons, and other light spirit colors.

PRUSSATE OF POTASH.—This is made from pearlash and animal substances, as horns and hoofs. It is very extensively used for dyeing Prussian blues, varying from a sky to a royal blue upon cotton fabrics.

QUERCITRON BARK.—This is obtained from the yellow oak, (*Quercus infectoria*) growing in North America. It furnishes an excellent yellow color. Alum and muriate of tin are the principal mordants employed in dyeing woollen and cotton, but oxalic tin

¹ See sure test for, page 308.

is the most efficient. It produces excellent drabs upon cotton with nitrate of iron. It is often only referred to as bark.

SAFFLOWER.—The flowers of the *Carthamus tinctorius*, grown chiefly in Spain, contain two coloring matters, yellow and red. The yellow is carried off by well washing in water until the flowers assume a bright crimson appearance. The red coloring matter is extracted by steeping in pearlash and water, with occasional stirring. The liquor is then pressed from the flower, and is ready for dyeing pink upon cotton fabrics combined with a little tartaric or sulphuric acid. It is little used since the introduction of saffronine and eosine.

SUPER ARGOL.—It is made from sal-enixum, or sulphate of soda, and sometimes from common salt cake. As an acid, it is used for dyeing drabs, and greens when turmeric is used instead of fustic, also for olives and browns. It is much cheaper than either argol or brown tartar, and in some cases is preferable.

CAMWOOD AND BARWOOD are dark red woods containing strong coloring matter which is of a permanent nature, and is generally used for dyeing browns and reds upon wool and cotton goods. They are most soluble in sulphuric acid diluted with water. In the dyeing of woollens, it is sometimes employed as a substitute for red sanders, producing a more fiery appearance in browns of light and middle shades.

CATECHU.—Catechu is an extract from the heart-wood of the khair tree of the East Indies. The coloring matter is extracted by sulphate of copper. Bichromate of potash is used to darken it. It is used in dyeing cotton a variety of shades, varying from a light drab to a dark brown.

CHEMIC OR SULPHATE OF INDIGO.—This is blue paste prepared from indigo, and contains more indigo in solution than any other preparation of it whatever. For dyeing purposes it is thus made; put into a stone jar 36 pounds of sulphuric acid, to which add 12 pounds of ground indigo gradually, stir well for one hour. After

standing for a few hours it will be fit for use. This chemic is much cheaper than extract of indigo for dyeing some colors, as greens, olives, and browns. Extracts of indigo are only modifications of this chemic, being partly neutralized and filtered.

FRENCH BERRY, OR PERSIAN BERRY.—This is the fruit of the *Rhamnus infectorius*. It yields a bright yellow coloring matter, which is employed in dyeing light yellow shades upon cotton, also for light greens, with either extract of indigo or prussiate of potash. It also gives the fawn shade to drabs. Combined with alum or crystals of tin a fine golden yellow is obtained.

SAUNDERS, OR RED SANDAL.—This is the wood of the *Pterocarpus santalinus*, grown in India. It possesses deep red coloring matter, and is used chiefly in dyeing woollen goods. It is more permanent than peach-wood, though not of so bright a color.

SAPAN WOOD.—This wood produces a red color similar to that obtained from peach-wood, but it is not much used for dyeing purposes. It is generally sold in the liquid state, and is used in padding and printing.

SUMAC.—This astringent vegetable production is extensively used, chiefly for cotton dyeing. It is used as the base of many colors. The best is that imported from Sicily. It has great affinity for iron, which, when combined with sumac in certain proportions, imparts to cotton a variety of shades from silver drab to black. It is sometimes spelled sumack, and often in the old country abbreviated to mack and mac.

FUSTIC OR YOUNG FUSTIC.—The best old fustic is imported from Cuba, and yields a permanent yellow coloring matter, when combined with alum and argol, in dyeing various shades of greens. It is also used after chroming for olives of different shades. Young fustic is chiefly used in dyeing yellows, oranges, and scarlets. It gives a bright yellow when combined with nitrate, muriate, or oxalic tin, the last being the most effectual. The young dyes brighter shades than the old.

GALLS.—The gall nut is chiefly imported from Aleppo. It yields an astringent black coloring matter when combined with copperas and logwood; and it is generally employed in dyeing silver drabs upon cotton, when combined with nitrate of iron. As a dyewood, it gives greater solidity than sumac for those light shades.

INDIGO is produced from the leaves of *Indigofera*, a plant cultivated in South America, East Indies, etc., it is a very permanent coloring matter, employed in dyeing the majority of colors, varying from a drab to an indigo blue. The color produced by it is often imitated by dyeing with logwood, worsteds, and woollens which have previously undergone the chroming process.

KERMES OR LAC DYE is obtained from an insect deposited on different species of trees in the East Indies and other places. It contains red coloring matter, very like that of cochineal, and is frequently used as a substitute for it, being thought by some chemists to possess more permanence. It dyes good scarlets along with nitrate of tin, or oxalic tin, and tartar. This dye is much cheaper than cochineal, and the difference of color is only slightly perceptible.

LOGWOOD.—This is a dark red dyewood, and is much employed in dyeing black upon silk, cotton, and woollen; also for blues and many other colors. Logwood on first being introduced into England, was denounced by the cultivators of the native wood, and even prohibited in England by Queen Elizabeth. All imported was to be destroyed, nor was it allowed to be used till the reign of Charles the Second; thus proving that zeal is often blind.

PEACHWOOD, LIMA-WOOD, AND BRAZIL-WOOD.—These are used for dyeing mock crimsons, maroons, and clarets, upon worsted, woollen and cotton goods. They dye bright colors, after a preparation of alum, and darker shades of the same colors, after a preparation of chrome. Hypernic is the American name for them.

MADDER.—This is obtained from the root of the *Rubia tinctorum*, which grows wild in the south of Europe, etc. It is an article of

great importance in dyeing. Madder possesses five distinct coloring principles, viz., madder red, madder purple, madder orange, madder yellow, and madder brown. These colors are of most use to calico printers. It is also used by dyers to deaden drabs. The brighter the color, and stronger the scent the better the quality.

COCHINEAL is a small Mexican insect containing strong coloring matter, very permanent. It is used in dyeing pinks, rose colors, oranges, scarlets, and crimsons. The mode of extracting the coloring matter is by means of nitrate of tin and muriate of tin; oxalic tin gives the brightest color. These acids for bright shades are combined with white or brown tartar. It is largely replaced now by coal tar color.

CUDBEAR (see also Archil).—Cudbear is a dry powder of a fine blue-red color, and will dye a ruby itself, either upon silk, worsted, or woollen; a violet, with a little logwood; a purple or adelaide, by previously undergoing the chroming process. It is used in dyeing lavenders, drabs, and various other shades for the red part of the color.

TURMERIC.—This is the root of a plant cultivated in the East Indies, and contains much yellow coloring matter. It is frequently used instead of fustic, but is not so permanent.

MYRABOLINS.—An egg-shaped nut with much the same properties as galls, though not so strong but much stronger than sumac, otherwise used the same.

GLAUBER'S SALT AND ITS USE IN DYEING.—Neutral sulphate of soda is mostly known as Glauber's salt and sold in white crystals. It contains remarkable chemical properties rendering it very valuable in woollen dyeing. By combining with acid the neutral sulphate is transformed into bi-sulphate, rendering it very valuable in the tinctorial art, not only in aniline colors, but if introduced into archil, cudbear, redwoods, turmeric, madder, logwood, fustic, etc., much more of these baths are exhausted and utilized. With

soluble indigo equally good results are obtained, though by an opposite principle, namely, preventing a too rapid or uneven fixation. Its solubility presents a singular phenomena as at 32° F., with 100 parts of water only 5 per cent. is dissolved. The solubility then commences and rapidly reaches its maximum at 90° F. when 100 parts of water will dissolve 322 parts of the salt, and at higher temperature the solubility lessens. About 10 pounds may be used with advantage to 100 pounds of woollen goods, whether dyed with aniline or woods.

AMMONIA PASTE.—Strong ammonia 1 quart, water 1 quart, ground cochineal 2 pounds; stir them all well together in a stone pot, tie up the mouth of it tightly, and set it to work in a slightly warm place for two days when it will be fit for use.

GREEN EBONY appears to be little known in the United States, but it is to be preferred to fustic for yellows and greens, as it is bright and stands the acid better. It is also used for best blacks on silk in place of fustic as not being so harsh.

SECTION XV.

COLORS.

PRIMARY OR ELEMENTARY COLORS.

THERE are three elementary colors, termed “primary,” from which all other colors are derived, and there are three composite colors, termed “secondary,” formed by the combination of two of the primary colors. The three primary colors are red, yellow, and blue; and the three secondary colors are orange (the union of red and yellow), green (the union of yellow and blue), and violet (the union of blue and red). There is another color called indigo (the union of blue and violet), which with the three primary and three secondary colors make the seven colors of the solar spectrum, often designated as the “prismatic colors.”

If a pencil of white solar light be passed through a glass prism, it will be refracted into the seven colors as just mentioned, and conversely, the merging of the seven colors into one, will produce a white pencil of light. If upon a disk the seven colors, or even the three primary colors, are painted, and the disk made to revolve with sufficient rapidity to blend the colors, the effect to the eye will be a white color. This may be termed the “optical composition” of these colors. On the other hand, if the three primary colors in pigments be mixed in certain proportions, black will be produced, and this may be termed the “physical composition” of these colors.

The optical composition and the physical composition of colors are two branches of the same study. The one belongs to the designer of the woven fabrics, and the other to the art of the dyer. There are certain expressions applied to colors that it may not be amiss to speak of, namely, tone, shade, tint, and hue. The tone of a color is a term used to denote the modification which the color, in its greatest purity, experiences by the addition of black or

white. By adding black to a pure color you heighten the tone and produce what is called a shade. By adding white to a pure color, you lower the tone and produce a tint. The expression hue is employed to designate the modifications that a color undergoes by receiving a small quantity of another.

It is most surprising that from three colors, red, yellow, and blue all the colors and shades are produced, yet such is the fact. By mixing either of the three, say for instance, blue and yellow a green is formed, or the red and yellow an orange. These are called secondary colors, as also the blue and red by which you get a violet. Even secondary colors can be very much varied, as for example, give less of the red and more of yellow, you get an amber, or give more of the red and less of the yellow, you have a scarlet. By the same rule take less of the yellow and more of the blue, and you have a peacock, or take most of the blue and less of the red you have a purple.

Now from these secondary colors come all the fuller, richer, and darker colors, and they in their turn, by being made thinner, produce what may be called their own reflections. Thus a peacock produces sea-green; violet a mauve or lavender, according to its blueness or redness; brown in like manner produces a drab. The reflection is complete, as a yellow brown produces a yellow drab, while a red shade produces a red drab. Now a brown must at least have three colors in its formation, red, yellow, and blue. It will at once be seen that its hue will depend upon the relative proportions of these three colors which go into its composition. For instance, where yellow and red prevail it will be medium, and when the blue prevails it will be dark just in proportion to the intensity of the blue. Brown then can be used according to its temperament, to mix with other colors to darken them, provided always that the colors chosen have the desired sympathy to unite. As for example, take 4 parts roseine and 1 part Bismarck you get a maroon, or in lieu of Bismarck add violet and you have a claret; or take your proportions according to the strength of the colors, say 4 parts green, 2 parts blue violet, 2 parts Bismarck, and you have a slate color bordering upon black. But vary them and you can ring what changes of brown you desire with them. Again, take violet and green, by them you can get a decided blue or any

shade of peacock, as they unite perfectly, the green being actually made from violet. It was in watching the actions and transformations of such things in my laboratory, that I conceived the idea of working out into a system of practical development all the missing links in the aniline colors and shades. The general principles of the same I now for the first time introduce to the reader.

THE CONTRASTING OF COLORS.

Field's theory is, that colors complementary to each other present a neutral gray, as their mean color, and this theory is still taught in the schools from his text-book. Now this is more fanciful than correct, as will be admitted if the harmonious grouping of colors is carefully studied. Let me give some examples:—

The mean color between pure red and pure green is not gray, but olive green, a sort of dull yellow.

The mean between pure yellow and pure purple is reddish gray.

The mean between pure blue and pure orange is also reddish gray.

Nothing is more self-evident than that the complementary of pure red is a sea green, such as may be seen in fresh verdigris which is as much green as blue.

The true complementary of pure green is clear pink of the blue cast. The true complementary of pure blue is a pure yellow.

HARMONY, DISCORD, AND CONTRAST OF COLORS.

By harmony of colors we understand colors placed side by side in such a manner that they do not injure the effect of each other, rather, on the contrary, complete each other, *i. e.*, they gain in intensity.

Harmony in colors does not depend on the will or caprice or personal taste of an individual, but it is based on the unchangeable laws of nature, which we shall immediately discuss.

Red and Green.—A red body reflects green rays, while, on the other hand, a green body reflects red rays. Therefore, green is the color which completes red, and similarly, red completes green. Both, therefore, gain in intensity.

Blue and Orange.—A blue body often reflects orange rays, and, inversely, an orange body will frequently reflect the blue

rays. Orange is, therefore, the complementary color of blue, and *vice versa*; therefore each intensifies the other.

Violet and Greenish Yellow.—A violet body reflects greenish-yellow, and, inversely, a greenish-yellow body reflects violet. Both colors, therefore, complete and intensify each other.

Indigo and Yellow.—Indigo reflects yellow, and yellow indigo rays; hence they are complementary, and intensify each other.

It would carry us too far to describe all the other colors which are complementary.

A. Two simple colors.

Red and Yellow.—Red appears darker purple, because the indigo rays are imparted to it from the yellow; yellow appears greenish, because green rays are imparted to it from the red.

Yellow and Blue.—Yellow takes away the orange rays from the blue, and appears reddish; blue absorbs the indigo rays from the yellow, and appears darker.

Blue and Red.—Blue appears greenish from the effects of the green rays of the red; red, on the contrary, from the orange rays of the blue, appears yellowish.

B. A compound color and a primary color, the latter being contained in the former.

Red and Orange.—Red absorbs the blue rays from the orange and appears bluish violet; orange is influenced by the green rays of the red and appears yellowish, *i. e.*, lighter.

Red and Violet.—Red beside violet appears yellower, because it receives the yellow rays from the latter; violet appears darker, more dusky, because greenish rays are absorbed by it.

Orange and Yellow.—Orange loses from its yellow and appears redder; the yellow appears more greenish.

Green and Yellow.—Green loses its yellow and appears darker, more blue; the yellow is influenced by the reddish rays of the green, and it appears reddish, *i. e.*, orange.

Green and Blue.—The green appears lighter, more yellow, as if it were faded; the blue appears reddish alongside of the blue, *i. e.*, like violet.

Violet and Blue.—The violet loses its blue and assumes a reddish appearance in comparison with the blue, that is, greenish.

C. Two compound colors which have one primary color in common.

Orange and Green.—Both colors contain rays of yellow, and each loses some of its tint by contact; the orange appearing more red, and the green more blue.

Green and Violet.—Both of these colors have blue in common, and hence by contact each loses its appearance; the green becoming more blue, and the violet more red.

Violet and Orange.—These two colors have the red rays in common, which are lessened by contact; the violet becoming more blue, while the orange appears more yellowish.

It has been stated above that red reflects green rays and the green reflects the red rays, that all colors have their completing or complementary shades, which may be observed by the eye. This statement will be confirmed in the following:—

If one fixes his eye for some time on a red object and then quickly looks away or closes the eye, it appears just as if the same object appeared before him in green. Similarly, a green object when stared at, produces a red effect when the eye looks away. When one looks at a blue object for some time, there is produced in the eye the sensation as if one saw an orange object, and contrariwise, an orange-colored object appears as if it were blue.

When these colors are seen singly, as for instance in the form of flowers or some other ornamentation, on a light gray background, and closely watched for some time, it will be found that after a while the gray ground will appear slightly tinged by the complementary coloring in the same way; with

Red,	the gray ground is tinged with greenish.
Green,	“ “ reddish.
Blue,	“ “ orange.
Orange,	“ “ bluish.
Violet,	“ “ yellowish.

With wall-papers and woven fabrics these facts have often been noticed and even have led to serious disputes. Thus, for instance,

at Paris, in a factory of wall-papers, a case occurred in which a color mixer was found fault with for having used greenish gray instead of an ash gray as a background for a pattern of red flowers and garlands. His justification, however, was at hand, in the shape of a remnant of the gray pigment, which, when examined by itself, was in reality of ash gray tint. It was Chevreul, the distinguished chemist and director of the Gobelin Manufactory at Paris, who related the previous case, and the difficulty was settled by his showing that the red flowers imparted the greenish tint to the gray ground. A similar circumstance occurred to a weaver. He received some black and blue yarn from a dealer, by which he was to produce a blue and black checkered cloth. When the goods were given to the merchant, he saw that the black was not so intense as the sample, and immediately charged the innocent weaver with having fraudulently substituted his beautiful black for a faded one. The weaver was on the point of being punished by the law, when Chevreul, in his expert testimony on the matter, clearly showed that the blue portions of the fabric reflected sufficient of the yellow rays to make the black appear brownish. Hence it is shown by experience that in such cases, as with the manufacturer of wall paper, the gray ground of the paper should contain some of the color which is to be used for the design which is to be placed on the same, in order to satisfy the complementary color.

If, in the case of the Parisian wall-paper, just mentioned, some red had been mixed with the gray, the ground would not have appeared greenish; and also, if the black yarn in the case of the weaver had been dyed a little more blue, the orange rays from the blue yarn would not have shown so much on the black.

Another interesting case of deception by the gradual contrast of colors is the following: A lady desiring to purchase some silk ribbons, and being undecided as to which shade to select, had samples of blue, violet, and green shown her at the same time. After a close examination of the blue ribbon she turned to look at the violet; to her astonishment it was not violet, but brown. Perfectly correct, from looking at the blue ribbons, the complementary color of the blue—orange—was found in her eye and was imparted to the violet, giving it the appearance of brown.

From the violet ribbon she proceeded to examine the green sample. Here she was again deceived, for, from previously looking at the violet, light yellow was imparted to the green, and it had the appearance of being faded. If, after her examination of the blue ribbon, the lady had turned to an orange object, her eye would have been refreshed, and in a fit condition to look at the violet. After finishing with the violet ribbons she should have looked at something light yellow, and then her eye would have been sensitive to the green. Therefore dealers should take pains to always show goods on papers of the complementary colors, *i. e.*, red materials on green paper, etc.

All observations on gradual contrast, according to Sherffer's explanation, produce the following result:—

“That in the first part of the observation of a color, a portion of the cornea of the eye becomes affected and tired by it, and that this tired portion, during the second part of the time (*i. e.*, the time of rest) perceives the complementary.”

If purple (red-purple red) is placed beside a brilliant carmine, the first appears darker, less bright, while the latter, on the contrary, becomes brighter, more fiery, almost like vermilion; if, however, the same carmine is placed beside vermilion, the carmine appears darker, that is, less bright; so that in one case the carmine appears fiery like vermilion, while in the other it appears darker purple.

The same takes place with vermilion, it appears alongside of the carmine much lighter, almost orange, puce-colored, but when brought in contact with orange puce it appears darker, carminish. Orange puce, which alongside of vermilion appears yellowish, when in contact with yellow shows reddish. Yellow in contact with orange puce appears yellowish green, and in contact with yellowish green it appears orange. Yellowish green alongside of yellow seems darker, *i. e.*, blue, and in contact with blue green, lighter, that is, more yellow. Blue green in contact with yellowish green looks almost blue, and in contact with blue, yellow green. Blue appears violet in contact with blue green, and blue green when in contact with violet.

An additional example of similar contrast is shown in the following: When light gray and dark gray are brought in contact,

the former appears lighter and the latter darker than they are in reality. Any one can try this by a simple experiment. Take two strips of light gray, and two strips of dark gray paper, and paste one light gray strip in contact with one dark strip, and then compare them from a short distance. It will soon be found that the light gray strip, which is in contact with the dark gray, appears much lighter than its isolated companion, while the dark gray seems darker, so that, therefore, the gray surfaces appear lighter and darker than in reality. A strong contrast is always noticeable between black and white. A black object on a white ground will appear much larger than it is in reality. For instance, a white stripe on a black surface seems broader than a black stripe on a white surface, although both are of the same width. The phenomena of simultaneous contrast, according to Scherffer, may be physiologically explained as follows:—

“When one of our senses receives a double sensation, one of which is active and strong, while the other is weak, it will be found that the latter is not felt. This must be particularly the case when both impressions are of the same kind, or when a strong effect from an object on one of our senses is followed by another of the same kind, which is milder and weaker.”

To test the correctness of the same, let any of the colors be placed upon a rotating disk, or by the method of reflection and transmission by means of a slip of polished glass, and their correctness will at once be recognized. Why more correct views do not prevail, is, I take it, because pupils have been content to be pupils, and not students. They have been too willing to accept the traditions of their fathers rather than give themselves the trouble to stop every now and then, and say, Is this so?

SECTION XVI.

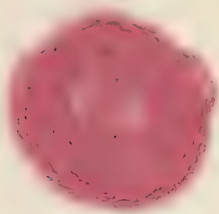
NEW RECEIPTS AND COLORS.

THE colors, or the methods of producing them, being mostly new, attention can be better called to them by presenting the same in a separate section.

No. 1.—*Bengale.*



No. 2.—*Erythrosine.*



No. 3.—*Eosine.*



All three are worked on in an alum bath from 5 to 10 pounds of alum to 100 pounds of goods; commence at 100° F., adding the dissolved color to shade, it may be brought up to a slow boil, but much boiling dulls the shades.

The eosine will color from the flesh shade shown, to a full intense scarlet, which has mostly been displaced with azo scarlet.

Cotton dyeing. 1st bath. 6 parts Marseilles soap, 3 parts glue for one-half hour at 100° F.

2d bath. Cold tin liquor 5° B. one hour.

3d bath. Red liquor 8° B.=11 T. two hours cold.

4th bath. Dissolved color to shade, raising heat from 100 to 200° F.; it requires a strong bath for dark shades, which does not get exhausted, and requires about one-third of color to next lot. For light shades, 10 ounces of color and 10 pounds Glauber's salt may be used in one bath to 100 pounds goods.

No. 4.—*Saffranine Rose.*



No. 5.—*Saffranine Pink.*

Saffranine is faster than the three former colors and more permanent, either on wool, silk, or cotton.

On wool. Dissolve about 4 ounces for the light, or 8 ounces for the dark shade, and add 4 to 6 pounds Glauber's salt to 100 pounds goods; commence at 100° and raise to boil. On silk, see page 39.

Cotton. Mordant with tannin, then run through tin liquor, from which well wash in three waters and dye to shade at hand heat.



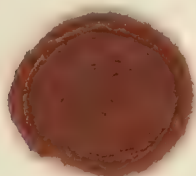
No. 6.—*Wool Scarlet.* (50 per cent. mixed goods.)

For 100 pounds of goods in yarn, felt, or mixed goods, in whatever proportion of cotton they may contain.

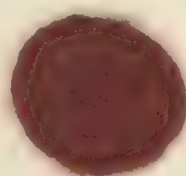
1st. bath. Prepare in cold red liquor for two hours, standing at 4° B., and without rinsing, dye in from 3 to 4 pounds wool scarlet

either shade required, commencing at 100° F. and only raising the heat when the cotton is full enough ; then raise, or even boil, until the wool is as full as required ; 2 pounds color will do after lots. They will not bear washing, but will bear exposure. For goods not particular about smutting it will produce a bright shade with little trouble, and on cotton it smuts little if any.

B.



B.B.



No. 7.—*Neutral Brown*. (50 per cent. mixed yarn.)

This is the most successful brown ever invented, and will dye equally well on all animal and vegetable fibres, indeed on nearly everything.

For wool, dissolve 2 pounds color and add 10 pounds Glauber's salt, enter at 100°, and bring to the boil till the color is taken up ; it will do well for hosiery or other things requiring to be washed.

On mixed yarn, prepare with tannin or sumac, and for light colors, use 1 pound of color, for dark, 2 pounds, for seal, 2½ or 3 pounds ; commence at a 100° F. and raise to the boil when wool and cotton will be a match.

Cotton, same as for mixed goods.

Silk, it will dye perfectly on silk, far quicker than archil or other processes, and at a moderate expense.

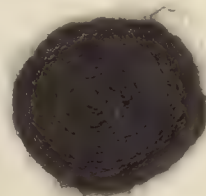
Jute, fibre, and other things require no mordant.

Turmeric may be used with it for yellow shades, fuchsine for redder, and green for bronze hues with the turmeric, using less brown.

50 per cent. Mixed Yarn.



Wool Yarn.



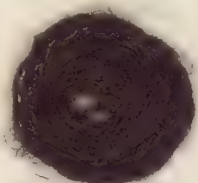
No. 8.—*Archilline*.

This is an acid color after the nature of fast reds, clarets, etc. It is perfectly fast and is an excellent substitute for archil, which shade it is made to exactly match, in place of which it can in every case be used. No doubt it will largely displace acid magenta, which has been much used, rather as a substitute for archil than for its direct shade.

Archilline, like acid magenta, can be used equally well for cardinals conjointly with orange, and for navy with indigo paste, or olive and bronze with indigo and turmeric, or browns with orange and indigo paste, any of which dark colors it is quite a saving of one half as against either archil or acid magenta.

Wool, 100 pounds, dissolve 1 pound color and add 10 pounds Glauber's salt, and 2 pounds oil vitriol. Commence at 100° F and raise to the boil; unlike archil it will readily take all the color up. If dyed hotter, the color should be added at two or three times.

Silk, dye in soap with a little acid.

No. 9.—*Acid Amber*.

Aniline acid amber is the last new yellow, and supplies the shade between yellow and orange so much desired, and no doubt will meet with large success as it is fast, bright, and cheap.

100 pounds on wool, dissolve 8 ounces color, 5 pounds Glauber's salt, add 2 pounds oil vitriol; enter at 100° F., and bring to boil; one-quarter the above will dye splendid straw color, and 1 ounce will color 100 pounds corn color clear and bright.

Silk, dye in soap and a little acid.

Mixed goods, prepare in red liquor.

Cotton, prepare as for mixed goods, neither of which requires to be washed from the preparation.



No. 10.—*Fancy Dyeing of several shades in the same skein.*

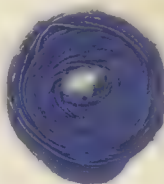
Any colors can be made use of for this class of work, provided they require no mordant, or if a mordant, it must be one that does not discolor the white, but the best colors for it are those that work on with oil of vitriol in with the dye. The yarn is placed on the usual sticks and lowered into the prepared dye bath to the depth of the required darkest part, and when that is dark enough, lower for the lighter shade, and then for the third, the part on the stick not having been removed from its first position is still white. If they have to be washed, the stick is taken up and removed to the wash-tub without being taken off, and dipped into the height of the dyed part only, then drain well before wringing.

The color shown was dyed with acid magenta, in four shades, each to be decidedly lighter than the last.



No. 11.—*New Cotton Violet.*

8 ounces of this color will dye 100 pounds goods without any assistance at a hand heat. For darker colors, prepare with just a little tannin or add the tannin with the color.



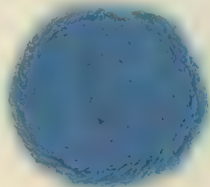
No. 12.—*Malachite Green,*

sometimes called acid green, not because it will work well in an acid bath, but for the reason that after dyeing it will look brighter if rinsed in a slightly soured water.

Take 8 ounces crystals, 8 ounces bicarbonate of soda to 100 lbs. of goods, commence at 100° F. and raise to boil, in yarns for half

an hour, in raw wool one hour. Add 2 pounds oil vitriol to cold water and well wash. Should yellower shades be required, give it picric in an acid bath after the color is on. Silk is dyed in a soap bath in which a little acetic acid is added.

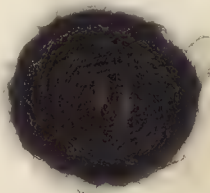
For cotton, see page 173, No. 11.



No. 13.—*Rich Brown.*

This full color, red shade brown, is dyed in the same manner as archillin, No. 8; it cannot be said to stand fulling for any great length of time, at the same time it will stand a fair amount of soaping; like all other colors intended to be fulled or soaped, it should be dyed a shade darker than required, as they lose a little in the operation in depth but not in brightness. It is a combination of archillin, double strength induline, and orange; one pound will dye a good shade at $2\frac{1}{2}$ cents, and the full shade as sample, with two pounds, costing 5 cents per pound.

For further particulars about any of the anilines mentioned in this work, apply to the author who keeps them in stock. (See Adver.)



APPENDIX.

RULES FOR CONVERTING AVOIRDUPOIS WEIGHTS AND MEASURES INTO METRIC.

To convert avoirdupois pounds into grammes, multiply by 500, and deduct 10 per cent., and then add $55\frac{1}{2}$ grains for exactness to every 1000 lbs. avoirdupois.

To convert avoirdupois pounds into half kilos, or pints into half litres, deduct about 10 per cent.

To convert avoirdupois ounces into grammes, multiply by 30 and divide by 5, then add 22 grains to the ounce.

To convert yards into metres deduct 10 per cent.

The following may be useful for mixing:—

One Troy grain or minim is equal to 0.06 gramme or fluidgramme, or 6 centigrammes.

One drachm or fluidrachm is equal to 4 grammes or fluidgrammes.

One ounce is equal to 30 grammes.

One gramme is equal to 15 grains or minims.

An average drop is equal to 0.05 fluidgramme.

An average teaspoon holds 5 fluidgrammes.

A dessert spoon 10 fluidgrammes.

A tablespoon 20 fluidgrammes.

A wine glass 75 fluidgrammes.

HYDROMETER TABLES.

Baumé's scale for liquids heavier than water is graduated from 0° to 72° . Its relation to direct specific gravity is shown in the following Table:—

$0^{\circ} =$	1.000	$27^{\circ} =$	1.216	$51^{\circ} =$	1.505
3	1.020	30	1.246	54	1.551
6	1.041	33	1.277	57	1.600
9	1.063	36	1.310	60	1.652
12	1.086	39	1.345	63	1.708
15	1.109	42	1.382	66	1.767
18	1.134	45	1.421	69	1.831
21	1.160	48	1.462	72	1.900
24	1.188				

The scale for liquids lighter than water extends from 10° to 40° , the lowest number representing the specific gravity of water, and the higher ones those of lighter liquids.

$10^{\circ} = 1.000$	$21^{\circ} = 0.930$	$31^{\circ} = 0.874$
11 0.993	22 0.924	32 0.869
12 0.986	23 0.918	33 0.864
13 0.980	24 0.913	34 0.859
14 0.973	25 0.907	35 0.854
15 0.967	26 0.901	36 0.849
16 0.960	27 0.896	37 0.844
17 0.954	28 0.890	38 0.839
18 0.948	29 0.885	39 0.834
19 0.942	30 0.880	40 0.830
20 0.936		

Beck's scale, for liquids heavier than water, runs from 1° , which is slightly above the specific gravity of water, to 70° . It is a most inconvenient scale.

$1^{\circ} = 1.0059$	$25^{\circ} = 1.1724$	$48^{\circ} = 1.3934$
2 1.0119	26 1.1806	49 1.4050
3 1.0180	27 1.1888	50 1.4167
4 1.0241	28 1.1972	51 1.4286
5 1.0303	29 1.2057	52 1.4407
6 1.0366	30 1.2143	53 1.4530
7 1.0429	31 1.2230	54 1.4655
8 1.0494	32 1.2319	55 1.4783
9 1.0559	33 1.2409	56 1.4912
10 1.0625	34 1.2500	57 1.5044
11 1.0692	35 1.2593	58 1.5179
12 1.0759	36 1.2687	59 1.5315
13 1.0828	37 1.2782	60 1.5454
14 1.0897	38 1.2879	61 1.5596
15 1.0968	39 1.2977	62 1.5741
16 1.1039	40 1.3077	63 1.5888
17 1.1111	41 1.3178	64 1.6038
18 1.1184	42 1.3281	65 1.6190
19 1.1258	43 1.3386	66 1.6346
20 1.1333	44 1.3492	67 1.6505
21 1.1409	45 1.3600	68 1.6667
22 1.1486	46 1.3710	69 1.6832
23 1.1565	47 1.3821	70 1.7000
24 1.1644		

Cartier's scale for liquids lighter than water runs from $10^{\circ} =$ water, to 44° . Its relation to direct specific gravity is shown in the following Table:—

10° = 1.000	22° = 0.916	34° = 0.845
11 0.992	23 0.909	35 0.840
12 0.985	24 0.903	36 0.835
13 0.977	25 0.897	37 0.830
14 0.970	26 0.891	38 0.825
15 0.963	27 0.885	39 0.819
16 0.956	28 0.879	40 0.814
17 0.949	29 0.872	41 0.809
18 0.942	30 0.867	42 0.804
19 0.935	31 0.862	43 0.799
20 0.929	32 0.856	44 0.794
21 0.922	33 0.851	

The direct scale of specific gravity assumes water to be 1, or 1.000, all heavier liquids requiring larger numbers, and all lighter ones numbers smaller than unity. This scale shows at once the weight per gallon of any liquid, the first two figures to the left hand representing pounds (avoirdupois), and the two or more following to the right being decimal fractions of a pound. Thus, if a sample of double muriate marks 1.450, a gallon of it weighs $14\frac{1}{2}$ lbs.

Twaddle's scale makes water = 0, and the strongest oil of vitriol = 170°. Unlike direct specific gravity, it extends only to liquids heavier than water. For greater accuracy, the scale is arranged on a set of six instruments, numbered progressively upwards. Thus a No. 1 Twaddle ranges from 0° to 32°.

The relation between Twaddle's scale and direct specific gravity is very simple. To convert a degree of Twaddle into the corresponding degree of direct specific gravity, multiply by 5, and add 1.000 to the product. Thus, if a bleaching liquor marks 7° Twaddle, its specific gravity is—

$$\begin{array}{r}
 7 \\
 5 \\
 \hline
 35 \\
 1.000 \\
 \hline
 1.035
 \end{array}$$

A sample of single aquafortis marks 33° Twaddle. Its specific gravity is then—

$$\begin{array}{r}
 33 \\
 5 \\
 \hline
 .165 \\
 1.000 \\
 \hline
 1.165
 \end{array}$$

If the specific gravity has been taken, the degree of Twaddle may be found by reversing this rule, subtracting 1.000 and dividing the remainder by 5. Thus, a sample of double aquafortis marks specific gravity 1.350. Its degree on Twaddle's scale will be—

$$\begin{array}{r}
 1.350 \\
 1.000 \\
 \hline
 5 \overline{) .350} \\
 \hline
 70^\circ \text{ Twaddle.}
 \end{array}$$

In some hydrometers, graduated for direct specific gravity, the first figure is omitted. On such, water marks 0° , and the above-mentioned sample of double aquafortis 350° . A peculiar hydrometer—called the ammonia glass or ammonia meter—is used in some districts for the sale of ammonia. It ranges from 10° (water) to 45° , representing the lightest liquors. It very nearly agrees with Baumé's light glass. Hydrometers give inaccurate results if applied to—

- a.* Hot liquids.
- b.* Glutinous liquids, solutions of gum, starch, size, etc.
- c.* Effervescing liquids.
- d.* Liquids holding solid matters in suspension.

Hot liquids should be allowed to cool, or, if it be necessary to observe their specific gravity at elevated temperatures, a comparative trial should be made on the liquid while hot, and on a portion when cold, so that the indication may be corrected. If it be needful to take the specific gravity of any liquid coming under the heads *b*, *c*, and *d*, a gallon should be accurately weighed.

In chemical, dye, and print works, where hydrometers are placed in the hands of foremen for frequent use, they should be regularly brought at some stated time to the laboratory for verification.

COMPARISON OF THE DEGREES OF BAUMÉ'S AND TWAD-
DLE'S HYDROMETERS, WITH SPECIFIC GRAVITIES.

The specific gravity of liquids is generally noted on the Continent for liquids heavier than water by Baumé's hydrometer, while for liquids lighter than water that of Cartier is mostly employed.

These various scales may be, by certain formulas, converted into each other, but, as practical men generally do not like to trouble themselves with long calculations, but want for their experiments everything as far as possible at their hand, it was thought advisable to give, in the following, these comparative scales in full for liquids heavier than water:—

Baumé.	Specific gravity.	Twaddle.	Baumé.	Specific gravity.	Twaddle.
0	1.000	0	39	1.345	69
1	1.007	1.4	40	1.357	71.4
2	1.013	2.6	41	1.369	73.8
3	1.020	4	42	1.381	76.2
4	1.027	5.4	43	1.395	79
5	1.034	6.8	44	1.407	81.4
6	1.041	8.2	45	1.420	84
7	1.048	9.6	46	1.434	86.8
8	1.056	11.2	47	1.448	89.6
9	1.063	12.6	48	1.462	92.4
10	1.070	14	49	1.476	95.2
11	1.078	15.6	50	1.490	98
12	1.085	17	51	1.505	99
13	1.094	18.8	52	1.520	104
14	1.101	20.2	53	1.535	107
15	1.109	21.8	54	1.551	110.2
16	1.118	23.6	55	1.567	113.4
17	1.126	25.2	56	1.583	116.6
18	1.134	26.8	57	1.600	120
19	1.143	28.6	58	1.617	123.4
20	1.152	30.4	59	1.634	126.8
21	1.160	32	60	1.652	130.4
22	1.169	33.8	61	1.670	134
23	1.178	35.6	62	1.689	137.8
24	1.188	37.6	63	1.708	141.6
25	1.197	39.4	64	1.727	145.4
26	1.206	41.2	65	1.747	149.4
27	1.216	43.2	66	1.767	153.4
28	1.225	45	67	1.788	157.6
29	1.235	47	68	1.809	161.8
30	1.245	49	69	1.831	166.2
31	1.256	51.2	70	1.854	170.8
32	1.267	53.4	71	1.877	175.4
33	1.277	55.4	72	1.900	180
34	1.288	57.6	73	1.944	188.8
35	1.299	59.8	74	1.949	189.8
36	1.310	62	75	1.974	194.8
37	1.321	64.2	76	2.000	200
38	1.333	66.6			

From the specific gravity of a liquid given in the above Table its weight per gallon may be easily calculated, as the first two figures from the left hand stand for pounds, while the next preceding ones give the decimal fractions of a pound; for instance, if the specific gravity of hydrochloric acid is 1.160, a gallon of it will weigh 11.6, or rather more than $11\frac{1}{2}$ lbs.

Now a few words about the use of the hydrometer may not be out of place. As important as the gauge glasses are, still, among practical men in this country, they are frequently misused. First of all the hydrometer of whatever scale it may be ought never to be used for hot liquids; it is useless for liquids which contain solid matter in suspension, and also for liquids of a sticky nature. Further, the hydrometer never gives a proof of the superiority of one liquid over the other (as long as equal purity has not been previously shown), but merely its specific gravity; hence, if we meet one liquid marking heavier on Twaddle than another, this would be no proof that the former is more valuable, as for instance, hydrochloric acid, standing 34° T., may be under some circumstances inferior to one standing 26° . Lastly, before using, the hydrometer ought to be quite dry.

THERMOMETER SCALES.

To convert Centigrade (Celsius) into Fahrenheit.—If the temperature be above the freezing point of water (32° F. = 0° C.), multiply by 9, divide by 5, and add 32 to the quotient. If it be below freezing point (32° F. = 0° C.), but above 0° F. (= -18° C.), multiply by 9, divide by 5, and subtract the result from 32° . If below -18° C. (= 0° F.), multiply by 9, divide by 5, and subtract 32° from the result.

Réaumur's scale, in which the boiling point of water is made 80° , and the freezing point, as in the Centigrade, 0° , is still used in many German dye and print works.

To convert Réaumur into Centigrade, whether above or below freezing point, multiply by 5 and divide by 4.

To convert Centigrade into Réaumur, multiply by 4 and divide by 5.

To convert Réaumur into Fahrenheit, or *vice versa*, the rules

above given for the conversion of Centigrade into Fahrenheit, etc., will apply, 4 being used respectively as multiplier or divisor instead of 5.

COMPARISON OF THE DEGREES OF FAHRENHEIT, CENTIGRADE, AND RÉAUMUR THERMOMETERS.

The difference in the scales of the thermometers in general use is frequently a mystery to practical men. Why the degrees as shown on Fahrenheit's, Centigrade, or Réaumur's thermometers should be different they cannot well conceive when they come to think about them. It may, therefore, be interesting to explain this matter.

In all thermometers, whether made after the system of Fahrenheit, Celsius, or Réaumur, the degrees commence at a point called zero, which always indicates a great degree of cold, and rise to warmer points with varying degrees of rapidity. Celsius and Réaumur commenced at the freezing point of water, and called this zero, and made respectively 100 and 80 degrees between this point and the boiling point of water. From the fact that Celsius divided the distance between the freezing and the boiling points of water into 100 degrees, his thermometer has been called the Centigrade, and has come into general use in France, where the decimal system has found so much favor.

Into all the facts respecting the gradation of thermometers it is unnecessary to enter; suffice to say that investigations which have been most carefully made show the natural zero of Fahrenheit's scale to be $-461^{\circ} 2'$, Centigrade -274° , and Réaumur's $219^{\circ} 2'$. These remarks show the difference between the scales of each thermometer, and the systems on which they are constructed.

For all ordinary purposes experience has shown that the scale of Fahrenheit is to be preferred to that of the Centigrade, from the fact that each degree indicates a much smaller range of temperature.

Fahrenheit.	Celsius or Centigrade.	Réaumur.	Fahrenheit.	Celsius or Centigrade.	Réaumur.
+212	+100	+80	+158	+70	+56
211	99.44	79.56	157	69.44	55.56
210	98.89	79.11	156	68.89	55.11
209	98.33	78.67	155	68.33	54.67
208	97.78	78.22	154	67.78	54.22
207	97.22	77.78	153	67.22	53.78
206	96.67	77.33	152	66.67	53.33
205	96.11	76.89	151	66.11	52.89
204	95.55	76.44	150	65.55	52.44
203	95	76	149	65	52
202	94.44	75.56	148	64.44	51.56
201	93.89	75.11	147	63.89	51.11
200	93.33	74.67	146	63.33	50.67
199	92.78	74.22	145	62.78	50.22
198	92.22	73.78	144	62.22	49.78
197	91.67	73.33	143	61.67	49.33
196	91.11	72.89	142	61.11	48.89
195	90.55	72.44	141	60.55	48.44
194	90	72	140	60	48
193	89.44	71.56	139	59.44	47.56
192	88.89	71.11	138	58.89	47.11
191	88.33	70.67	137	58.33	46.67
190	87.78	70.22	136	57.78	46.22
189	87.22	69.78	135	57.22	45.78
188	86.67	69.33	134	56.67	45.33
187	86.11	68.89	133	56.11	44.89
186	85.55	68.44	132	55.55	44.44
185	85	68	131	55	44
184	84.44	67.56	130	54.44	43.56
183	83.89	67.11	129	53.89	43.11
182	83.33	66.67	128	53.33	42.67
181	82.78	66.22	127	52.78	42.22
180	82.22	65.78	126	52.22	41.78
179	81.67	65.33	125	51.67	41.33
178	81.11	64.89	124	51.11	40.89
177	80.55	64.44	123	50.55	40.44
176	80	64	122	50	40
175	79.44	63.56	121	49.44	39.56
174	78.89	63.11	120	48.89	39.11
173	78.33	62.67	119	48.33	38.67
172	77.78	62.22	118	47.78	38.22
171	77.22	61.78	117	47.22	37.78
170	76.67	61.33	116	46.67	37.33
169	76.11	60.89	115	46.11	36.89
168	75.55	60.44	114	45.55	36.44
167	75	60	113	45	36
166	74.44	59.56	112	44.44	35.56
165	73.89	59.11	111	43.89	35.11
164	73.33	58.67	110	43.33	34.67
163	72.78	58.22	109	42.78	34.22
162	72.22	57.78	108	42.22	33.78
161	71.67	57.33	107	41.67	33.33
160	71.11	56.89	106	41.11	32.89
159	70.55	56.44	105	40.55	32.44

Fahrenheit.	Celsius or Centigrade.	Réaumur.	Fahrenheit.	Celsius or Centigrade.	Réaumur.
+104	+40	+32	+50	+10	+8
103	39.44	31.56	49	9.44	7.56
102	38.89	31.11	48	8.89	7.11
101	38.33	30.67	47	8.33	6.67
100	37.78	30.22	46	7.78	6.22
99	37.22	29.78	45	7.22	5.78
98	36.67	29.33	44	6.67	5.33
97	36.11	28.89	43	6.11	4.89
96	35.55	28.44	42	5.55	4.44
95	35	28	41	5	4
94	34.44	27.56	40	4.44	3.56
93	33.89	27.11	39	3.89	3.11
92	33.33	26.67	38	3.33	2.67
91	32.78	26.22	37	2.78	2.22
90	32.22	25.78	36	2.22	1.78
89	31.67	25.33	35	1.67	1.33
88	31.11	24.89	34	1.11	0.89
87	30.55	24.44	33	0.55	0.44
86	30	24	32	0	0
85	29.44	23.56	31	-0.55	-0.44
84	28.89	23.11	30	1.11	0.89
83	28.33	22.67	29	1.67	1.33
82	27.78	22.22	28	2.22	1.78
81	27.22	21.78	27	2.78	2.22
80	26.67	21.33	26	3.33	2.67
79	26.11	20.89	25	3.89	3.11
78	25.55	20.44	24	4.44	3.56
77	25	20	23	5	4
76	24.44	19.56	22	5.55	4.44
75	23.89	19.11	21	6.11	4.89
74	23.33	18.67	20	6.67	5.33
73	22.78	18.22	19	7.22	5.78
72	22.22	17.78	18	7.78	6.22
71	21.67	17.33	17	8.33	6.67
70	21.11	16.89	16	8.89	7.11
69	20.55	16.44	15	9.44	7.56
68	20	16	14	10	8
67	19.44	15.56	13	10.55	8.44
66	18.89	15.11	12	11.11	8.89
65	18.33	14.67	11	11.67	9.33
64	17.78	14.22	10	12.22	9.78
63	17.22	13.78	9	12.78	10.22
62	16.67	13.33	8	13.33	10.67
61	16.11	12.89	7	13.89	11.11
60	15.55	12.44	6	14.44	11.56
59	15	12	5	15	12
58	14.44	11.56	4	15.55	12.44
57	13.89	11.11	3	16.11	12.89
56	13.33	10.67	2	16.67	13.33
55	12.78	10.22	1	17.22	13.78
54	12.22	9.78	-0	17.78	14.22
53	11.67	9.33	1	18.33	14.67
52	11.11	8.89	2	18.89	15.11
51	10.55	8.44	3	19.44	15.56

Fahrenheit.	Celsius or Centigrade.	Réaumur.	Fahrenheit.	Celsius or Centigrade.	Réaumur.
—4	—20	—16	—23	—30.55	—24.44
5	20.55	16.44	24	31.11	24.89
6	21.11	16.89	25	31.67	25.33
7	21.67	17.33	26	32.22	25.78
8	22.22	17.78	27	32.78	26.22
9	22.78	18.22	28	33.33	26.67
10	23.33	18.67	29	33.89	27.11
11	23.89	19.11	30	34.44	27.56
12	24.44	19.56	31	35	28
13	25	20	32	35.55	28.44
14	25.55	20.44	33	36.11	28.89
15	26.11	20.89	34	36.67	29.33
16	26.67	21.33	35	37.22	29.78
17	27.22	21.78	36	37.78	30.22
18	27.78	22.22	37	38.33	30.67
19	28.33	22.67	38	38.89	31.11
20	28.89	23.11	39	39.44	31.56
21	29.44	23.56	40	40	32
22	30	24			

FRENCH MEASURES OF CAPACITY.

	Eng. cub. inches.			
Millilitre . . . . .	.061028			
Centilitre . . . . .	.61028			
Decilitre	6.1028			
LITRE ¹	61.028	=	gal.	pint.
Decalitre	610.28	=	0	1.76
Hectolitre	6102.8	=	2	1.60
Kilolitre	61028.	=	22	0.08
Myriolitre	610280.	=	220	0.80
		=	2201	

FRENCH MEASURES OF WEIGHT.

	Eng. grains.				
Milligramme . . . . .	.0154				
Centigramme . . . . .	.1543				
Decigramme	1.5434				
GRAMME ²	15.4340				
Decagramme	154.3402	=	lb.	oz.	dwt.
Hectogramme	1543.4023	=	0	0	6
Kilogramme	15434.0234	=	0	3	4
Myriogramme	154340.2344	=	2	8	3
		=	26	9	15

A kilogramme is $2\frac{1}{4}$ lbs. avoirdupois.

¹ A cubic decimetre.

² A gramme is the weight of a cubic centimetre of water.

GLOSSARY.

It may be useful to the uninstructed to have explained to them some of the names and terms used in the trade.

Acetate of Lead—Sugar of Lead.

Alumina—A pure form of Alum.

Animalize—The action of Mordants on cotton fibre causing them to take up dye similar to animal fibres.

Aqua Ammonia—Liquid Ammonia.

Aqua-fortis—A weaker form of Nitric Acid.

Bark—Mostly Quercitron bark.

Catechu—The proper name for Cutch.

Chemic—A term used by bleachers for the bleach liquor containing the Indigo for bluing.

Chemic Blue—Sometimes called by dyers Indigo Paste, or Indigo Extract, all three of which refer to the prepared paste of indigo, as does also Sulphate of Indigo.

Chlorine—Referring to the bleach-liquor made from Chloride of Lime.

Chromate of Lead—190 parts Chromate of Potash and 100 parts Sugar of Lead.

Chrome—An abbreviation for Bichromate of Potash.

Chroming—The act of preparing goods (Mordanting) for dyeing.

Dishful—About ten pounds.

Divi Divi—Similar to Catechu.

Double Muriatic Acid—A stronger form of Muriatic Acid.

Double Nitric Acid—A stronger form of Nitric Acid.

Double Tin—A stronger form of Tin Liquor.

Fah.—Refers to Fahrenheit's instrument to test heat.

Iron, To—Means to pass through a preparation of Nitric Acid in which iron is dissolved.

Gambier—Similar to Catechu.

Granulated Tin or *Feathered Tin*—Block Tin melted, and at a height allowed to fall slowly into a vessel of water, when it becomes small and thin for tin solutions.

Hypernic—American name for the family of Brazil wood, Lima-wood, and Peachwood.

Kettle—Means any vessel used for dyeing, of whatever material made.

Mac or *Mack*—For Sumac.

Magenta, *Fuchsine*, and *Roseine*—Simply a confusion of names, as they are one and the same in manufacture.

Mordant—When not otherwise defined means to pass through or lie in a preparation of Tannin, for light colors one pound of Tannic Acid, mostly called Tannin, or, as an equivalent, two pounds of Bird's Aniline Mordant, or ten pounds Sumac. In either case to be scalded out before the goods are entered. For dark colors half extra of the Tannin or Aniline Mordant, and often twenty pounds of Sumac are required to one hundred pounds of goods.

Muriatic Acid—The correct name for Hydrochloric Acid and Spirits of Salts.

Oil Soap—Preferably made from palm-oil (very good is made from Cotton and Linseed Oils); it has this advantage, that when dissolved it remains so, and is fit for constant use, and especially is it useful for cleaning goods that will not stand warm soap.

Oxidizing—The air acting on dyed goods and turning them dark.

Pailful—Three to four gallons.

Panama Bath—A soap bath with Acetic or Sulphuric Acid in it for dyeing silks.

Prussiate—Prussiate of Potash either in the red or yellow form.

Sal Soda—The term used in America for washing Soda.

Soda Ash—About twice as strong as Sal Soda.

Soda—The term used in England for washing crystals.

Sour, To—To pass the goods through an acid bath, mostly sulphuric, to taste just tart, and used warm.

Speck Dyeing—Filling up cotton warp after woollen dyeing (see Felt Dyeing). Touching up specks of cotton showing on dyed goods.

Spend—The act of drawing out the color of dye woods.

Spirit, To—Sometimes means to pass through a warm bath of Sulphuric Acid, or Spirits of Salts, to clear and heighten the work, or to remove stains from goods that have been cleaned ready for dyeing mostly by garment dyers. To spirit, however, often means to pass through one of the tin liquors after cotton goods have been in a tannin liquor; both of which prepares it for taking up the brighter shades of dyes.

Standard Colors—Those generally in use and dyed by accepted rule.

Strip—The act of discharging old dye in goods.

Sulphuric Acid—The proper name for Oil of Vitriol.

Sulphate of Copper—The correct name for Blue Vitriol or Bluestone.

Sulphate of Iron—The correct name for Copperas.

Sulphuring—The action of Brimstone on the fibre of goods in a bleaching process.

Tot—Equal to about one-third of a pint.

Tartar—Sometimes refers to Cream of Tartar and sometimes to Red Argols. They are both the same thing, the white being purified, but for dyeing purposes the best red will generally answer as well as the white.

Tin, To—To pass the goods through one of the preparations of tin liquor, as Muriate of Tin or Oxymuriate of Tin.

Top off, To—The act of giving a last dye bath to improve some previous one.

Tw.—Refers to Twaddle's instrument to test the strength of acid and other solutions.

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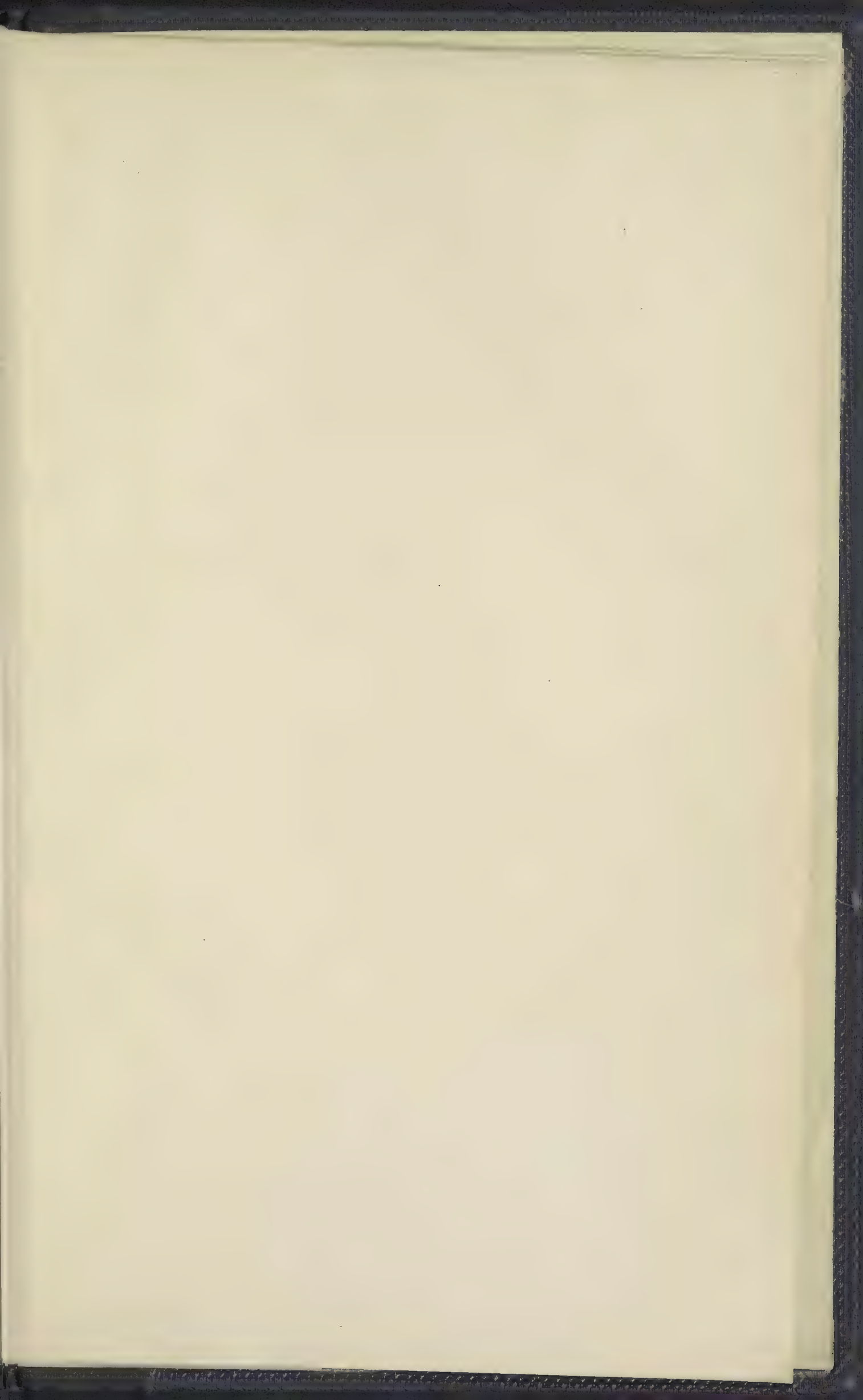
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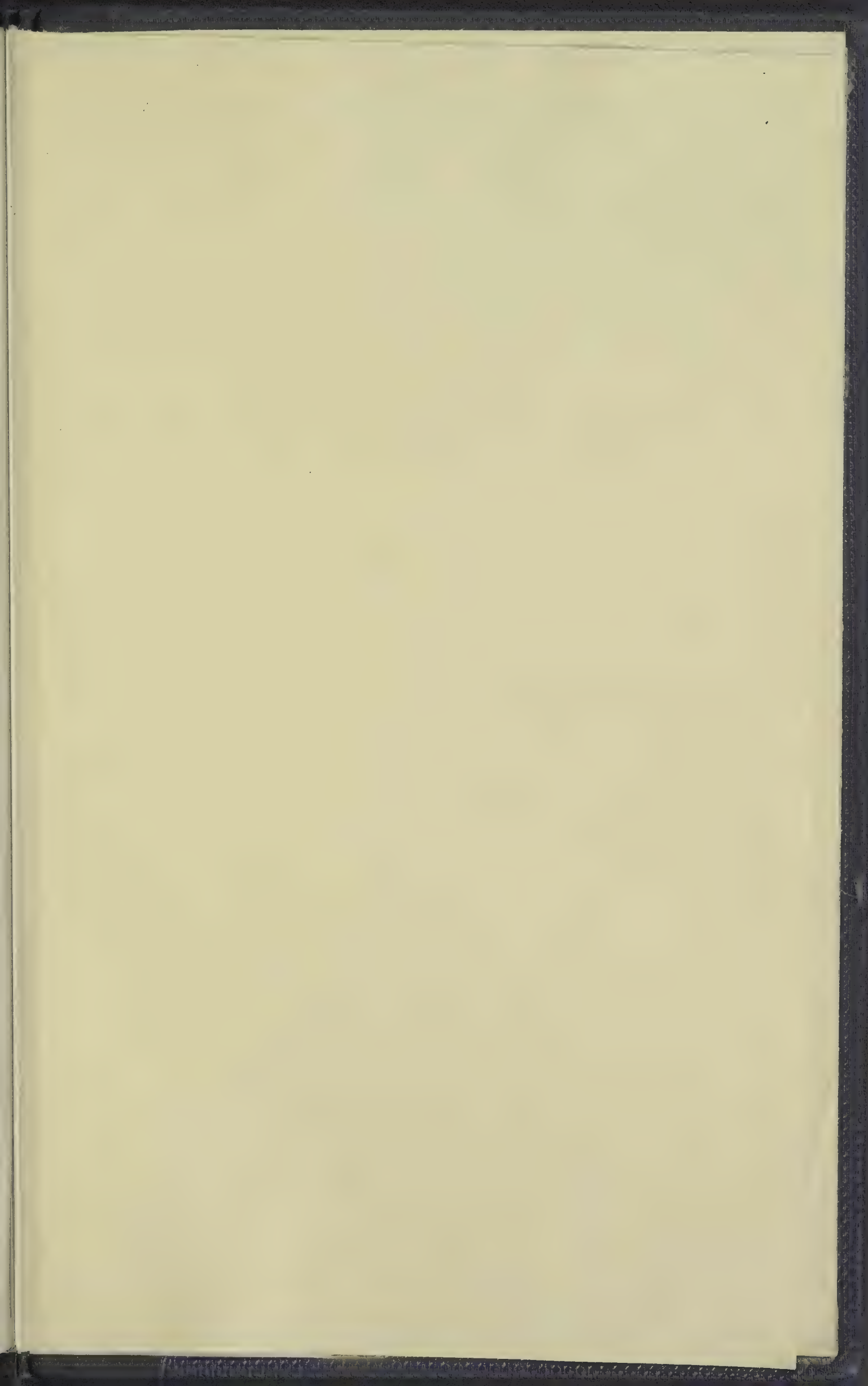
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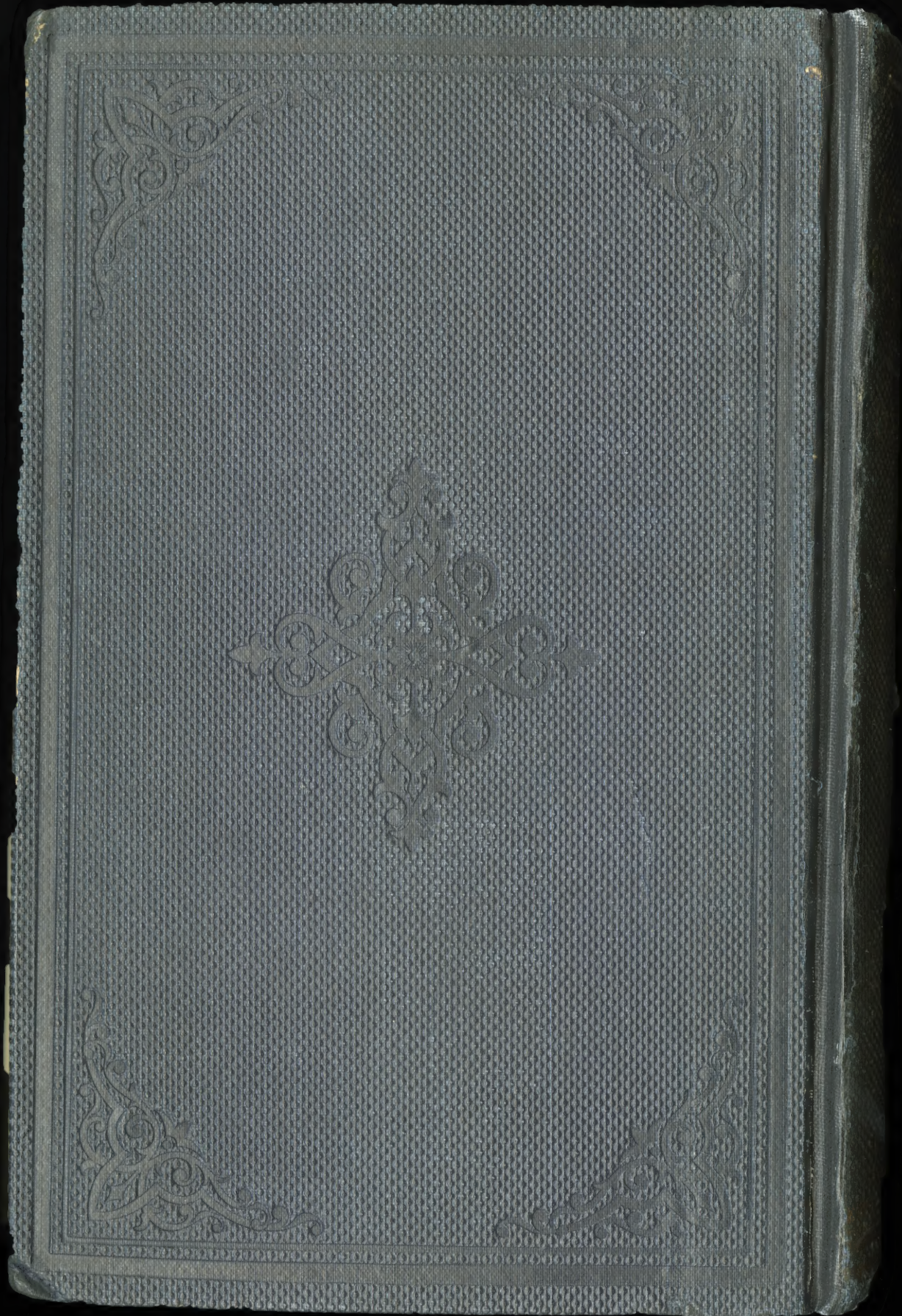
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